(Established 1832.)

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## RAILWAY SHOPS.

BY R. H. SOULE.

X.

THE STOREHOUSE.

(INCLUDING THE OIL HOUSE.)

The storehouse is a vital part of the shop establishment, and closely identified with its current operations; it is not only a warehouse for keeping material in, but is the agency through which all receipts and shipments are handled, whether for storehouse account or not.

Its operating force is sometimes under the direction of the master mechanic and the motive power department; sometimes under the general storekeeper and supply department, and in a few cases directly under the general manager or other executive officer having jurisdiction over all operating departments. The materials under storehouse control are seldom confined to the building itself, or to its immediate vicinity; but almost invariably include bar iron supplies for and at the smith shop, plates and sheets for and at the boiler shop, lumber for and near the planing mill, and often pig iron for the foundry. The foremen of these departments are virtually deputy storekeepers for these supplies, and their laboring gangs ordinarily load and unload them; therefore, although the storehouse control is, under some systems, vested in departments other than the motive power, its operations never can be isolated from current shop operations and must always be closely identified with them. Unless shop officers have a considerable voice in deciding what kinds and quantities of materials shall be carried in stock, good output results are not to be expected.

The oil house is always under storehouse control, and the stationery stock is usually so. The storehouse is sometimes purely local, sometimes serves a district, and sometimes a whole road or system. The department idea is seldom observed, and but few roads maintain separate establishments for motive power, maintenance of way, and transportation supplies. It is therefore evident that as regards size and floor space the storehouse is not likely to bear any very definite relation to the other buildings in a shop group, but its proportions will have to depend on local conditions for each road.

As it must be served by at least one track it will be long and relatively narrow, and may be of any number of floors and with or without a basement; it may have balconies or galleries; may have tracks on one side or both sides or on the inside; and should be fire proof or of slow burning construction.

The location should theoretically be as nearly central as possible, but practically this is determined largely by track connections, surrounding storage space, fire risk, etc. Storehouse tracks are apt to be blocked with cars at times and thus impede transit across them—this should be studied and avoided in the layout. The stationery storehouse is usually embodied in the general storehouse, but as its shipments are almost invariably in small packages and by passenger train, the passenger station would be an ideal location for it.

The interior of the storehouse should be arranged on certain general principles: Alleyways between racks to run at right angles to main gangways and to length of building; racks to be adjustable, so that spaces between shelves can be varied; space near track side and wagon platform to be fitted up for packing and shipping; main floor arranged for supplies currently handled and other floors for surplus stock; office to be preferably near shipping end or side.

TABLE 17.

STOREHOUSES, ARRANGED IN ORDER OF GROUND AREA.

INCLUDING STOREKEEPER'S OFFICES, BUT EXCLUDING PLATFORMS AND MASTER MECHANIC'S OFFICES.

| Location. | Railroad. | Ground Area (approximate). Sq. ft. | No. of Floors. | Total Floor Area (approximate). Sq. ft. | Isolated? | Main Floor Level. | Track Arrangements. |
|---|---|---|---|---|---|---|---|
| Oelwein, Ia. | C. G. W. | 2,820 | 4 & basement | 10,080 | No | High* | One side only. |
| Concord, N. H. | B. & M. | 4,000 | 2 | 6,400 | Yes | High | Both sides. |
| Reading, Pa. | P. & R. | 7,000 | 1 & balcony | 12,080 | No | High | Center only. |
| Dubois, Pa. | B., R. & P. | 7,200 | 2 | 13,200 | Yes | High | Both sides. |
| Chicago, Ill. | Armour | 7,500 | 1 & balcony | 9,180 | Yes | Low | One side only. |
| McKees Rocks, Pa. | P. & L. E. | 7,500 | 2 | 15,000 | Yes | Low | Both sides. |
| Baring Cross, Ark. | M. P. | 7,500 | 2 & basement | 18,750 | Yes | High | One side only |
| Roanoke, Va. | N. & W. | 11,550 | 2 | 14,700 | Yes | High | One side only |
| Omaha, Neb. | U. P. | 14,400 | 2 & balcony | 31,616 | Yes | High | Both sides. |
| Elizabethport, N. J. | C. R. R. of N. J. | 15,000 | 1 | 15,000 | Yes | High | Both sides. |
| Depew, N. Y. | N. Y. C. | 15,216 | 2 | 20,520 | Yes | High | One side only. |
| Topeka, Kan. | A., T. & St. F. | 17,000 | 2 & basement | 51,000 | Yes | High | Both sides. |
| Collinwood, O. | L. S. & M. S. | 18,000 | 3 | 54,000 | Yes | High | Both sides. |
| Oak Grove, Pa. | N. Y. C. | 18,900 | 1 & balcony | 17,875 | Yes | High | One side only. |
| Burnside, Ill. | I. C. | 21,000 | 2 & basement | 61,600 | Yes | High | Both sides. |
| Readville, Mass. | N. Y., N. H. & H. | 22,500 | 1 | 22,500 | Yes | High | Both sides. |
| Sayre, Pa. | L. V. | 37,400 | 1 | 37,400 | Yes | High | Both sides and center. |
| Moline, Ill | C., R. I. & P. | 50,000 | 2 | 100,000 | Yes | High | Both sides. |

*High = 4 ft. elevation (box car floor level); low = on ground level.

Table 17 gives the ground areas and total floor areas for eighteen storehouses, sixteen of which have been built within the last five years; in this, the following points may be noted:

The Oelwein storehouse is the only one having four stories and basement. This storehouse is not isolated, but is in one end of the main shop building. It is also peculiar in that the main floor of the storehouse is on the same level as the gallery floor of the shop, and the main floor of the shop is on the same level as the basement floor of the storehouse; this is due to the difference in level between shop yard and transportation yard. What seems like an inconvenient working arrangement here is redeemed by good crane service between the "pulpit" (extension of the storehouse main floor) and the main floor of the shop below, and by good electric derrick service between the storehouse platform and the shop yard and transfer table below.

The Concord storehouse is small for the size of the shop, and has been supplemented by a castings shed placed some distance away from it, but adjacent to the machine and erecting shop.

The Reading storehouse is not isolated but is introduced

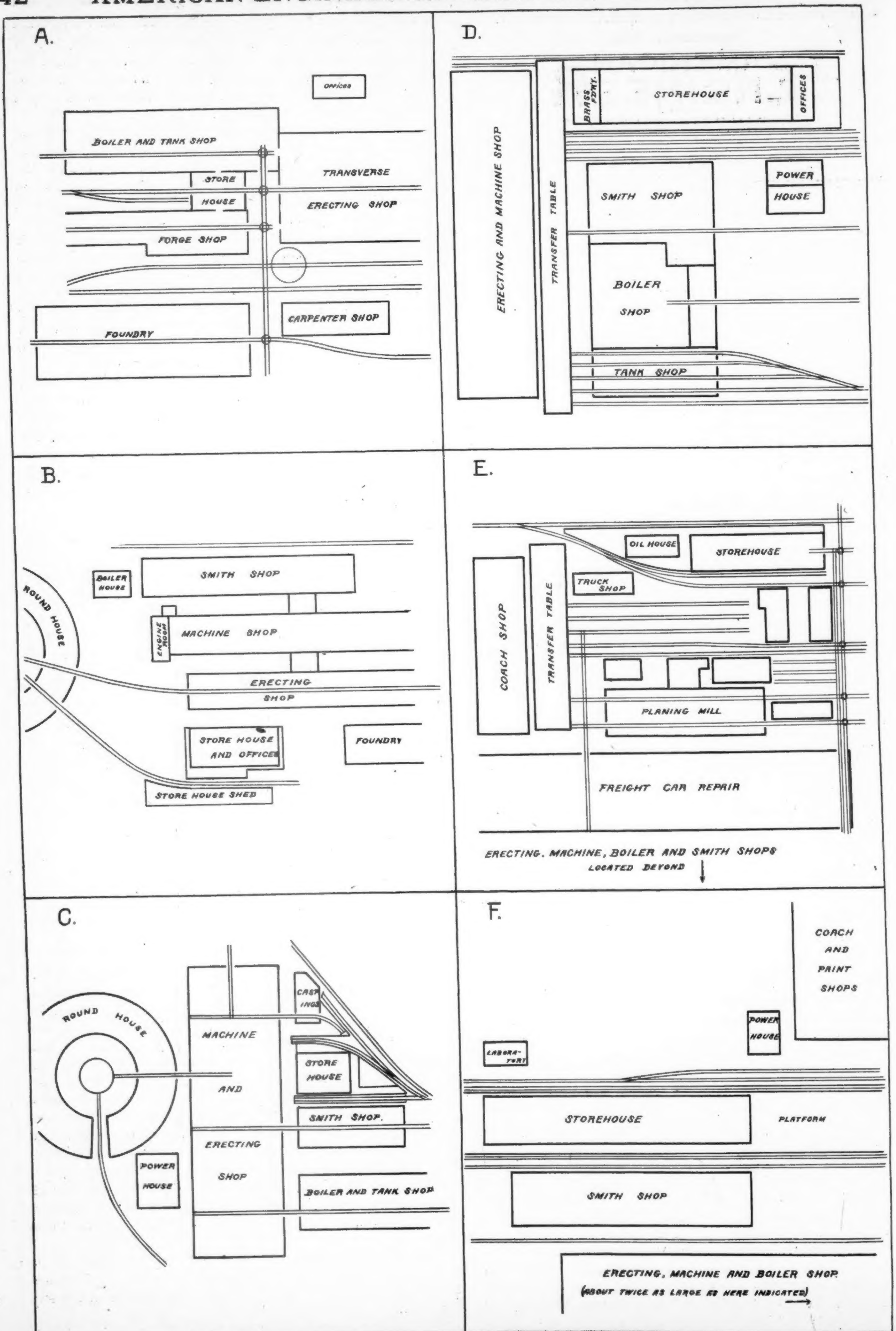



FIG. 5.—TYPICAL STOREHOUSE TRACK ARRANGEMENTS.

A, B AND C = EASY OF ACCESS; D, E AND F = DIFFICULT OF ACCESS.

between the boiler shop and the smith shop having common walls with both; this makes it impossible to have track approaches on either side of the building, and one is brought directly through the center. The floor level being high compared with the track level, the track way forms a pit in the floor which presumably has to be spanned by plank bridges for working purposes.

The Armour storehouse, at Chicago, though not a regular railway storehouse, is mentioned as illustrating the possibility of placing the building on the ground level with a depressed track alongside; it is also notable because it has easy access on three sides, without obstructions (tracks, platforms, etc.). The McKees Rocks storehouse is similarly located on the ground level, but has two depressed tracks, one on either side, and is the only railroad storehouse, here listed, which is so arranged; it is therefore worthy of careful consideration. The end of the storehouse building is quite close to the face of the main shop building, and all of the conditions are favorable to a free interchange between the two.

The Baring Cross, Topeka, Collinwood and Burnside storehouses form a group by themselves, as each has three working floors. Collinwood has three floors above the ground level, the others having two above the ground level with basements below.

The Omaha storehouse has two working floors and an intermediate balcony, and in this respect stands alone. Those at Baring Cross, Roanoke, Depew and Oak Grove have a track on one side only, and when the track is on the side of the storehouse building away from the other adjacent shop buildings, it makes a good working arrangement.

The Elizabethport, Readville and Sayre storehouses are all one story structures, Elizabethport and Readville having two tracks, one on either side, and Sayre having three, the additional one running through the center of the building (as at Reading), and thus giving four working platforms. The Moline storehouse leads all in both ground area and floor area, and, being 100 ft. wide with tracks at the sides only, much trucking will be required in its operation. The Sayre storehouse is also 100 ft. wide, but has three tracks, as above stated.

It will be noted that the storehouses of largest total floor area are generally in the west, a fact largely due to their several locations being remote from the base of manufactured supplies; but this is also influenced to a considerable extent by the system of handling supplies which prevails on the individual roads. Collinwood appears to have an exceptionally large storehouse for an eastern road, but it embodies the general stationery storehouse of the system.

With electric power generally available it is probable that the traveling crane will be regarded as an essential adjunct to every large storehouse of the future. This is foreshadowed at Moline, where a rectangle of 80 ft. by 400 ft. on the storehouse platform is covered by a 5-ton electric traveling crane, and similar installations, though on a smaller scale, are creeping in elsewhere.

Accessibility to the storehouse by track connections is sometimes favored to such an extent in the original layout that accessibility by foot and by hand truck are sacrificed. Fig. 5, illustrating several storehouse track arrangements, is introduced in this connection; it gives six examples from actual practice, three (A, B, C,) are presented to illustrate arrangements providing facility of access, and the other three (D, E. F,) to illustrate difficulty of access (from other shop buildings).

Sometimes the storehouse is not centrally located, but oftener there are physical obstructions, such as transfer pits or tracks to be crossed. Transfer pits are absolutely prohibitive of easy interchange and tracks are apt to be blocked with cars—even when not so blocked they can be crossed with a hand truck or barrow only where planked over. It will always contribute to good results if the side of the storehouse nearest to the principal shop buildings has no track alongside of it. An ideal arrangement (not yet found in actual practice) would be to have the storehouse building on ground level with its track on one side only, its opposite broad side being open to access from the adjacent principal shop buildings; this is usually difficult to accomplish, however, on account of the connections to the depressed track, and would generally require that the storehouse track be along one edge of the property.

Iron racks for the storage of bar iron for smith shop use are susceptible of a great variety of design. The essentials are a firm foundation to sustain the heavy load, and that the horizontal members, at least, should be made of round bars or pipe to facilitate the handling of the contents. Boiler plates are stored most compactly and handled most easily if stood on edge, except when a lifting magnet is used, which requires that the plates be laid horizontal, but the use of the magnet has not yet extended largely to railway shops. At Elizabethport, and in a few other shops, the boiler plates are stored inside the shop, so as to come under the traveling crane. At the Juniata (Altoona) shops of the Pennsylvania R. R. the plates are stored in the yard to the westward of the boiler shop building, the traveling crane serving both shop and yard by passing through an opening in the gable end of the building.

The oil house is almost invariably a separate establishment from the storehouse, although under the same control. Its location is determined by such a variety of influences that no uniformity results; if the shop plant includes a large roundhouse the oil house is usually near it, to facilitate the delivery of oil, in cans, to locomotives, while if there is no roundhouse the location will ordinarily be conveniently close to the storehouse, with only enough intervening distance to minimize the fire risk. Any variation from this practice is usually due to purely local conditions, such as available track connections, etc. At the shop points listed in Table 17 the distances from storehouse to oil house range from a minimum of 25 ft., at Topeka, to about 1,125 ft. at Elizabethport, the oil house location in the latter case being determined by that of the roundhouse. In a very few instances, paint stores are kept in the oil house, and the location of the paint shop then has an influence in determining the oil house location.

As to the type of building for oil house purposes, three varieties prevail: The gravity type, with three different levels for supply, storage, and service; the gravity and lift type, with a minimum of two levels, one for supply and one for storage, the service level being either one of these or possibly a third; and the lift and gravity type, with two levels, one for storage and one for service. The lifting process may be accomplished by pumping or by compressed air, but it has been found by experience that compressed air under average shop conditions is apt to infuse suspended water into the oils with which it comes in contact, and therefore the illuminating oils are now seldom handled by this means but rather by pumps. The lubricating oils continue to be successfully handled by air, however. At outlying and isolated points where land is plenty, and compressed air not to be had, a gravity system is usually preferred, and by using horizontal tanks the necessary three levels can be obtained without going below ground level; at central points where conditions are different, operations conducted on a large scale, and the expense is justified, vertical tanks will be found preferable, as a given storage capacity can thus be concentrated into a smaller ground area. Heating coils should be under or alongside of tanks rather than in them, as repairs of internal coils would be burdensome and the leakage disastrous.

The oils for which separate storage is usually provided in the average railway oil house are: engine oil, cylinder oil, carbon oil of low fire test, carbon oil of high fire test, car oil, fuel oil, etc. Where power is available mixing tanks can easily be arranged and with proper pipe connections can easily be operated and the staple mixed oils produced at low cost.

The service taps in a large oil house should all be piped to a common point with oil cocks ranged over a drip pan, and in a lift system the lifting agency, whether compressed air or pump,

may be controlled from the same point. The most conspicuous examples of the lift gravity system are the recent installations at Omaha (Union Pacific) and Pocatello (Oregon Short Line); these being practically duplicate plants. Their underlying principle is that the oil, received from the manufacturer (whether in tank cars or barrels), is pumped (by steam pumps in this case) into the storage tanks, and the oil used for service is drawn by gravity; under this system the storage tanks may be kept above ground and have to be elevated from floor level only enough to give the necessary head room for filling barrels, cans, etc. But where conditions permit making the necessary excavation it is believed that the gravity-lift system is superior to the lift-gravity system, as in the former, tank cars can be more quickly emptied and released, while the process of lifting can be done in detail installments to suit the requirements of service.

At Houston, Tex., on the Houston, East and West Texas Railway, there is an oil house fitted with vertical storage tanks, each of which has a false bottom forming a steam drum below for heating purposes. It is evident, of course, that either this steam drum must be strongly braced or else the steam fed to it must be passed through a reducing valve and brought down to a low pressure, unless, possibly, exhaust steam is used.

The Baltimore & Ohio have a standard arrangement of oil house for outlying roundhouse points, where the storage tanks are below ground level and under a steel and concrete platform which is about 30 ft. by 50 ft. At one end is the serving house of two floors. The lower one (depressed below ground level) being the place where supplies are drawn, and the upper one being for waste storage; these oil houses are operated on the gravity system throughout.

The Galena-Signal Oil Company issue a book of diagrams showing five alternative oil house plans, the estimated costs of which range from $1,000 up to $18,000.

*(To be Continued.)*

ERRATA:—We regret an unfortunate omission in the preceding article of this series. In the first column of the article, on page 1 (January issue), the 9th line from the bottom should read as follows: "capacity to evaporate 30-lbs. of water *per hour* into steam."

## AN IMPORTANT NEW TERMINAL-YARD LIGHTING AND POWER PLANT.

WEEHAWKEN, N. J.

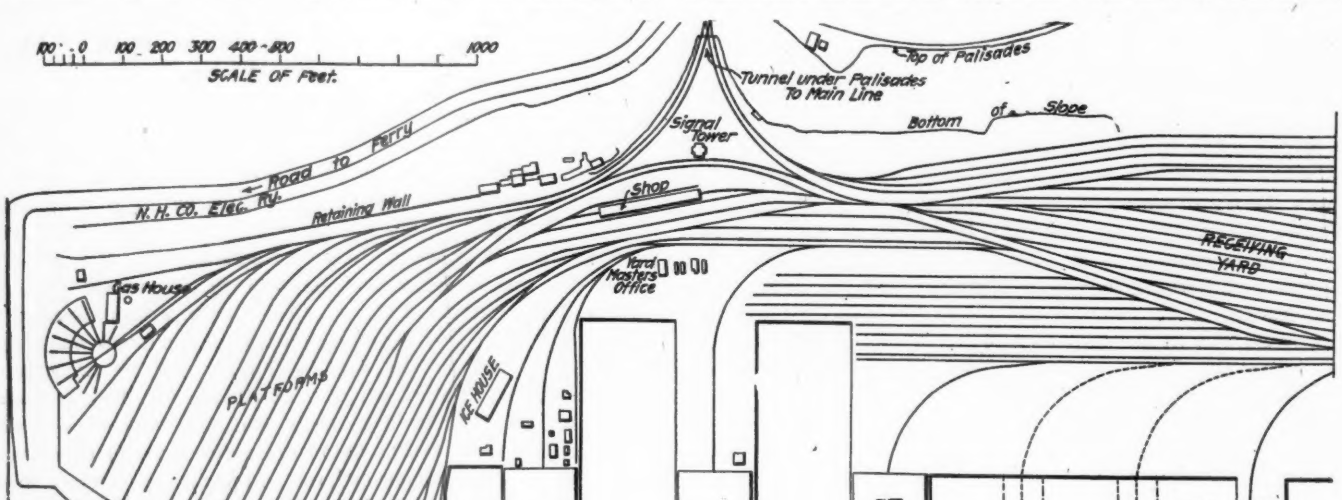
WEST SHORE RAILROAD.

I.

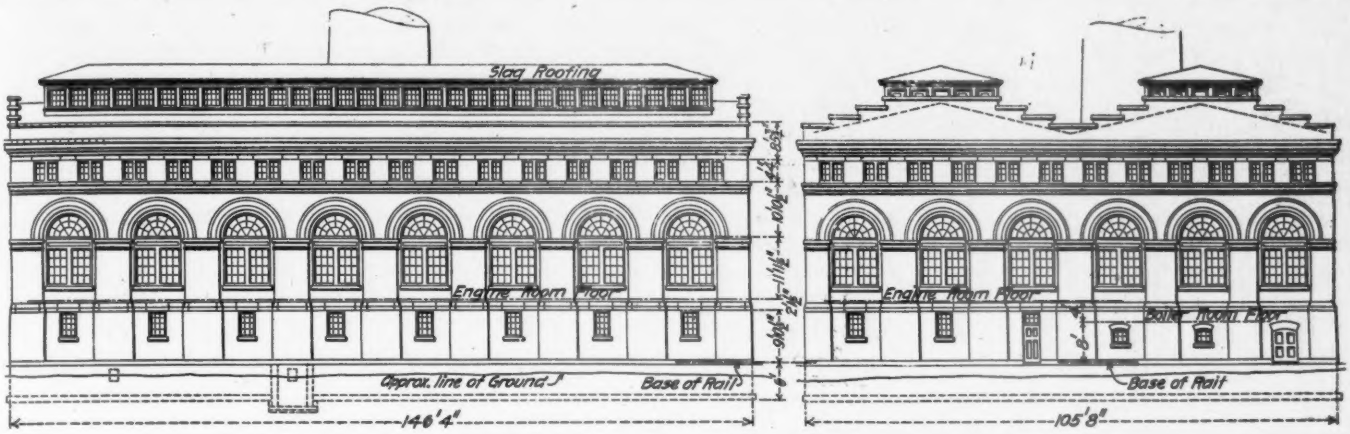
The installation of the large new power plant which is now in process of construction at the Weehawken, N. J. terminal of the West Shore Railroad, is a remarkable example of the applicability of electricity to the auxiliary service of a large steam railroad. There are many uses for power in a large tide-water terminal of this nature, where besides the usual division repair-shop, yard and station lighting, etc., there are large export grain elevators and transfer bridges for the car floats, which require large amounts of power. It becomes a difficult and involved problem to supply the amount of power required under the old conditions of individual steam power plants, with the large amount of attendance required, as well as the ensuing uneconomical operation. Also the lighting of a yard of this size, with the older methods, is a problem of considerable magnitude, and one that became very expensive and complicated, if carried out to any degree of completeness.

With the introduction of the private central power station for the lighting of large railroad properties of this nature, however, comes naturally the suggestion of relief, in carrying the design of the plant to a further degree and embracing in its scope the generation of all the power required for electrical distribution to the various points of consumption. This is, in fact, the direction in which progress is tending; electric illumination for outdoor, as well as inside lighting, is by far the most practicable and satisfactory, and is practically the only lighting system that is given serious consideration for large installations of this character. With the initial expenditure for a lighting plant and its attendant expense of maintenance approved of, it is only a small step and one of comparatively little additional expense to add the necessary equipment for generating large quantities of power for electrical distribution.

The problem that was presented in the equipment of the West Shore terminal at Weehawken was that of lighting the




PLAN OF THE TIDE-WATER TERMINAL AND YARD OF THE WEST SHORE RAILROAD AT WEEHAWKEN, N. J.




FRONT AND NORTH END ELEVATIONS OF THE POWER HOUSE, SHOWING CHARACTER OF CONSTRUCTION AND ARCHITECTURAL DETAIL.

NEW TERMINAL YARD LIGHTING AND POWER PLANT.—WEST SHORE RAILROAD.

large car storage and classification yard, and also the large number of depot and shop buildings, as well as the grain elevators and dock buildings and facilities; also power was used in quantities at a large grain elevator and a much larger elevator was to be built and, in addition to this, power was required at a small repair shop, at the roundhouse, at the marine equipment repair shop, at the transfer bridge where car floats are loaded, and elsewhere. When the problem of providing a power plant for the large new elevator was taken up, it was seen to be only a step further, and moreover—one in the direction of progress, to erect a central power plant which should not only supply the power for the new and the old elevators, but also for the other power service and also for the entire lighting of the yards and all the buildings.

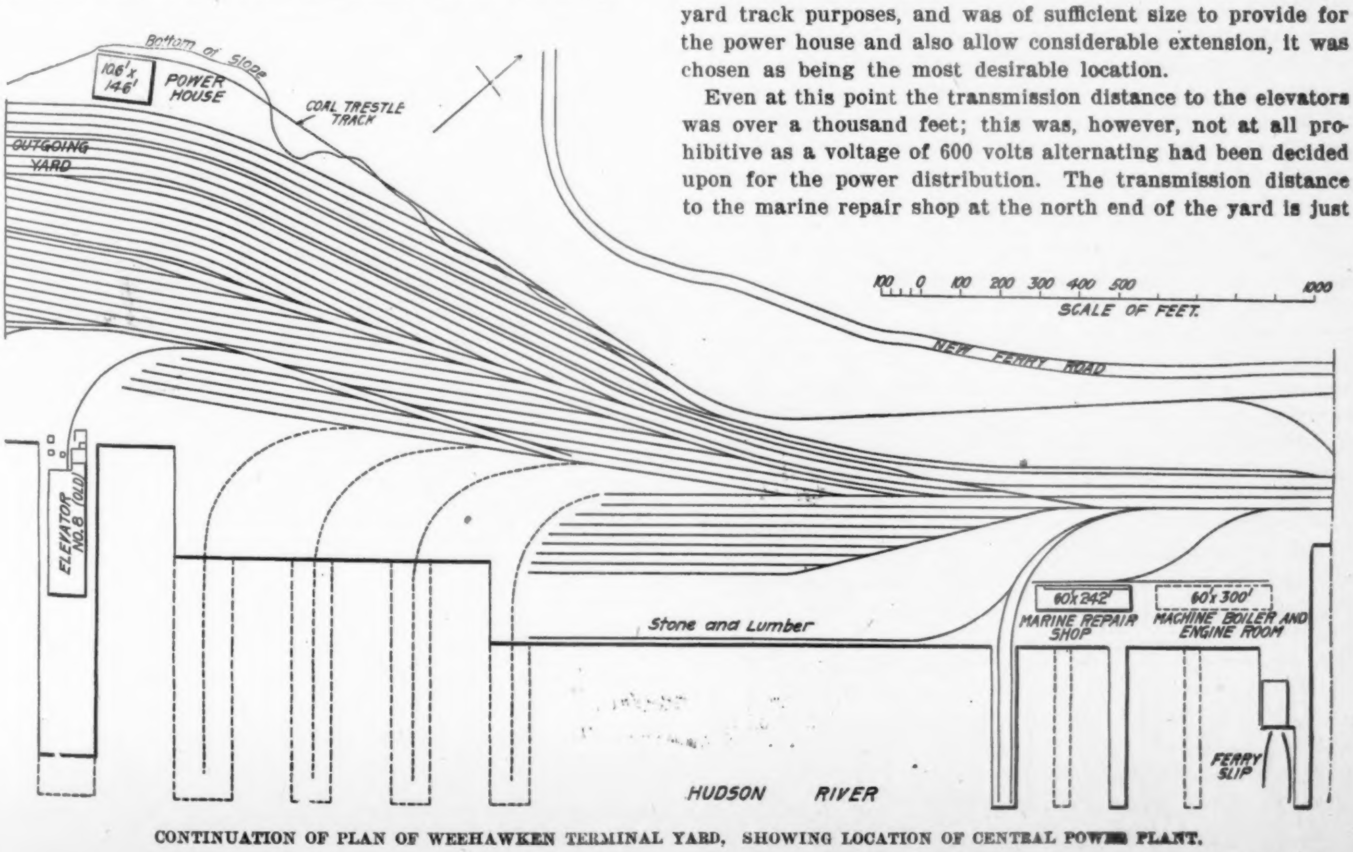
The result of careful consideration of the question from all points of view led to the decision in favor of the central power plant, and in consequence a magnificent plant is being erected, with a total generating capacity of over 3,000 rated horsepower. Many radical improvements are embodied in its design, which will render it particularly interesting as exemplifying the application of the latest principles to the designs of a power plant for mixed power and lighting service. Also interest is added on account of the severe limiting conditions imposed which governed the location and which materially affected the design.

LAYOUT OF THE YARD.

As may be seen from the accompanying engraving, showing the yard layout at Weehawken, the power is to be used at widely scattered points, the depot buildings and roundhouse being at one extreme end of the yard, the marine shops at the other end and the elevators at the middle. The total length of the yard is 6,700 ft., so that it at once became evident that the distribution problems would have to be carefully considered.

In this connection the location of the power plant was of the greatest importance. A central location was, of course, preferred, and in this instance, it became a necessity for the reason that the points of greatest power consumption were found to be at the elevators, which are located almost exactly at the middle of the yard. It was thought inadvisable to place the power plant close to the elevators on account of the poor foundation facilities near the dock, and yet on the other side of the yard the steep ascent of solid rock, known as the "Palisades," limited very much extension in that direction. A sort of recess in the foot of the Palisades, at a point opposite the elevator on Pier No. 8, however, seemed to lend itself naturally to the accommodation of the power plant building and presented the most desirable features for its location that could be found. Inasmuch as this site was inaccessible for yard track purposes, and was of sufficient size to provide for the power house and also allow considerable extension, it was chosen as being the most desirable location.

Even at this point the transmission distance to the elevators was over a thousand feet; this was, however, not at all prohibitive as a voltage of 600 volts alternating had been decided upon for the power distribution. The transmission distance to the marine repair shop at the north end of the yard is just




CONTINUATION OF PLAN OF WEEHAWKEN TERMINAL YARD, SHOWING LOCATION OF CENTRAL POWER PLANT.

one-half mile, while that to the old power plant in the depot at the south end of the yard, is over 3,500 ft. This old power station in the depot is the source of power for the present depot and yard lighting equipment, but will later be charged to serve as a substation, operated from the new power plant, for the local distribution of power and lighting at that point, and will supply power to the roundhouse and also to the motors for operating the aprons of the transfer bridges.

The export grain elevators will require the largest amounts of power. The new elevator, No. 7, will be equipped for motor driving in the latest and most up-to-date manner, and will have 3,300 horsepower in total motor capacity installed. The old elevator, No. 8, which is now driven by an old steam power plant nearby, will be driven by motors on the group system. The power feeders leading to the elevators will be carried through an underground conduit, while the other power transmission and lighting circuit wires will be carried on overhead pole lines.

#### POWER PLANT BUILDING.

The power house is a well designed building of steel and brick construction, with a particularly substantial steel frame. It is 146 ft. 4 ins. long and 105 ft. 8 ins. wide, outside, and is divided by a division wall into two sections, one—the engine room—located on the east side (toward the river) and the other—the boiler room—at the rear, or west side. The engine room is 143 ft. by 52 ft. inside the walls and has a free height of 28 ft. under the roof trusses; the boiler room is 143 ft. by 49 ft. 4 ins. inside and has a free height of 32 ft. beneath roof trusses, the boiler room floor being located 4 ft. lower than the engine room floor. Under the engine room there is a 12 ft. basement for steam piping, auxiliary equipment, etc., and under the operating floor of the boiler room there is a 10 ft. basement for access to the ash conveyor system.

The exterior appearance of the building is presented in the accompanying engraving. The architectural result is very pleasing and the design symmetrical. While no extraordinary efforts have been directed toward the exterior appearance, still the result indicates that care was taken to harmonize the details, and without sacrifice of the usefulness of any part. Ample daylight lighting is provided in both boiler and engine rooms, the window arrangement being of a most pleasing design. Both sections of the building have monitors in the roof which provide both lighting and ventilation.

Concrete construction entered largely into the construction of this building, the wall and engine foundations and the floors being of concrete. The composition of the concrete used in the footings of walls, foundations, etc., was one part of Portland cement to two of clean sharp sand and four of broken stone. The floors are laid with a first course of concrete composed of one part Portland cement to three parts of sand and six of broken stone, and this is covered with a top course, 1 in. thick of a stiff mortar consisting of equal parts of Portland cement and sand. The steel work will be referred to in a later article.

The entire main roof and roof of monitors is to be constructed of 3 in. concrete slabs, made of the first mentioned stone concrete, with No. 16 gauge galvanized iron wire. The upper surface of the roof slabs is made smooth with a course of mortar of equal parts of Portland cement and sand, laid during construction. The outside of this is covered with pitch and a coating of slag, graduated and bolted, for sizes ¼ to ⅝ in. The monitors are covered on sides and ends with 16 oz. sheet copper, crimped and moulded to conform to the details of construction, and extended within the window construction for weatherproofing. Inside roof drainage is provided to prevent freezing.

Other interesting details of the building will be presented in our next issue, in connection with sectional detail views of the building showing its equipment. We are greatly indebted for this information to Mr. Edwin B. Katte, the designer of the plant and electrical engineer of the New York Central and Hudson River Railroad Company.

*(To be continued.)*

## A NEW 50-TON BOX CAR.

### WITH STRUCTURAL STEEL UNDERFRAME.

#### MIDDLETOWN CAR WORKS.

The accompanying engravings illustrate a new box car that has been designed by and of which five were built by the Middletown Car Works to meet special requirements of the Illinois River Packet Company (the Turner-Hudnut Company, Pekin, Ill.) for handling grain shipments in their home territory, and also to seaboard cities. Features of particular interest have been introduced into the design of this car; the underlying idea has been:

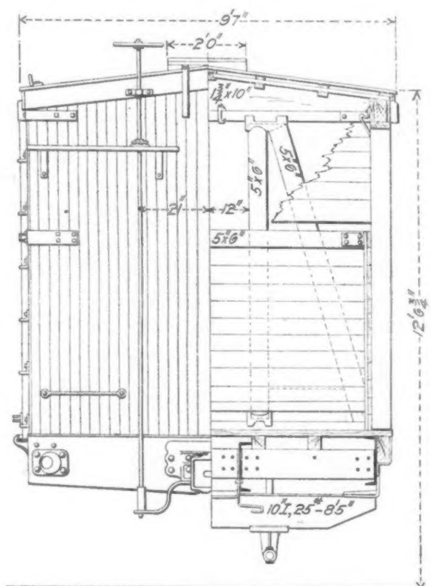
First—To secure sufficient cubical contents for 50 tons of grain;

Second—To use a structural steel underframe of simple type, that would facilitate repairs;

Third—To have ample strength in the underframe and superstructure to support the load and withstand service shocks;

Fourth—To follow the general lines for a standard box car as proposed by the M. C. B. Committee at the last Saratoga Convention.

With respect to cubical contents, it was thought desirable to base this on a length inside of 40 ft., for the reason that to




HALF END ELEVATION AND CROSS SECTION OF THE STEEL UNDERFRAME BOX CAR.

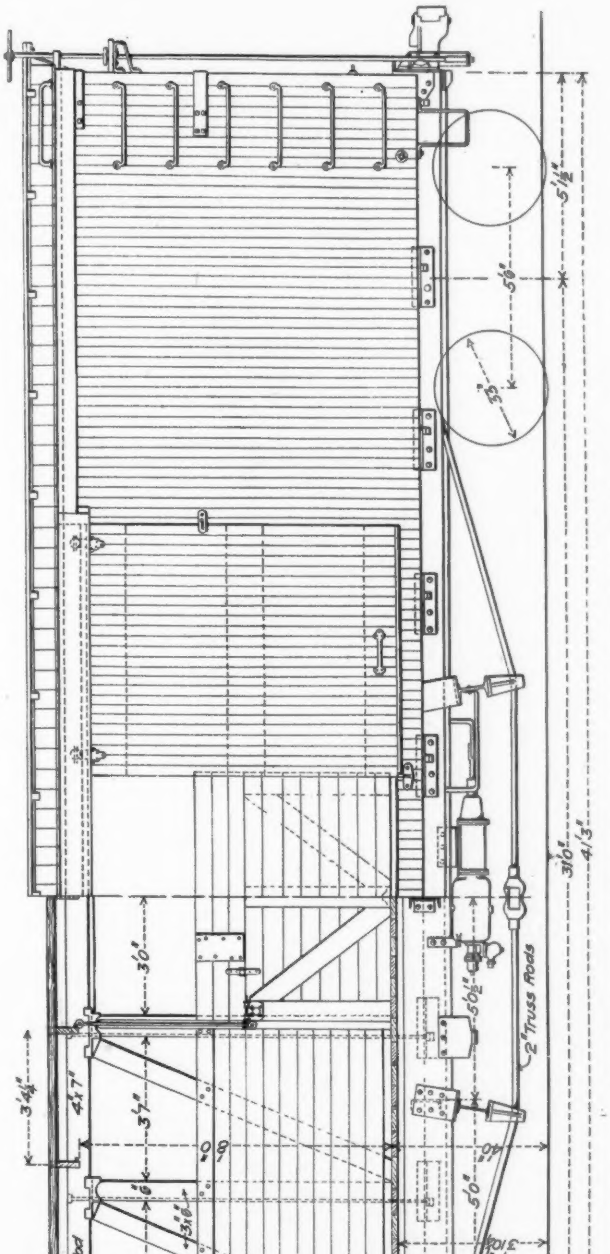
load 50 tons of wheat into a 36-ft. car is a difficult matter at most elevators. A car 40 ft. long gives considerably more head room when loaded, and from this point of view seems more desirable than the American Railway Association standard length. The inside clear width is 8 ft. 6 ins.; height from floor to underside of carlins 8 ft. 0 in., and cubic contents to these dimensions 2,720 cu. ft., or 54.5 cu. ft., per ton of rated capacity.

In selecting the type of underframe, the designer, Mr. George I. King, has worked out a design which, in many respects, follows the general lines of wooden car construction, at least to the extent of employing sills of a uniform depth throughout, which are assisted in carrying the load by the use of truss rods.

There are four steel sills extending from end sill to end sill, each longitudinal member being a 15-in. channel, 33 lbs. per foot. These sills are supported at each bolster by a bent plate construction consisting of a top bolster bar 12 ins. x ¾ in., and a bottom bolster bar 12 ins. x 1 in., the latter reinforced by 3 x 2½ x ¼-in. angles to prevent buckling. Each side sill is secured to the ends of the body bolster by four 1-in. rivets at each joint. Suitable malleable iron fillers are used between the center sills at the body bolsters to resist the upward thrust due to the load at the center plates; to serve the double purpose of stiffening the center sills and to firmly fasten the top

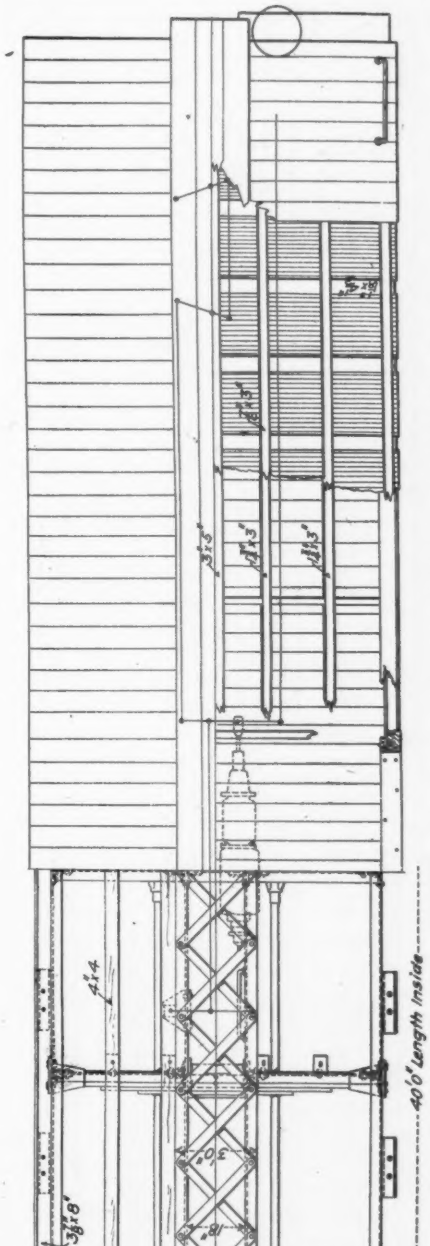
bolster member to these sills, a gusset plate 36 x 5-16 x 60 ins. is interposed between the top surface of the center sills and the under surface of the upper bolster member. Each side bearing is a malleable casting riveted to the lower bolster member, and to prevent distortion of the bolster by side bearing shocks, a 6 x ¾-in. brace has one end riveted to the bolster over the side bearing and the other end secured to the top flange of the center sill.

The two truss rods which extend from bolster to bolster, with turnbuckles at the center of car, are 2 ins. in diameter, with ends upset to 2½ ins., and at the bolsters each rod is pinned between two heavy forged straps. These straps are anchored up at their outer ends, the anchors passing through slots in the large gusset plates above mentioned and fitting tightly against the outer edges of the top bolster bars. Since the horizontal component of the stress in the truss rods is transmitted largely to the top flanges of the center sills, they are latticed together by a double system of 2½ x ½-in. lattice




PART LONGITUDINAL SECTION AND PART ELEVATION OF THE STEEL UNDERFRAME CAR.

Showing Arrangement of Cross Ties for Truss Rod Struts, and Supporting Brackets Below Sills.



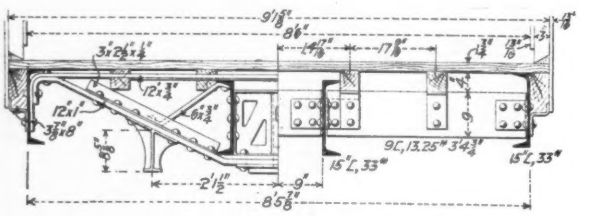

PART SECTION AND PART PLAN OF THE STEEL UNDERFRAME BOX CAR FOR THE ILLINOIS RIVER PACKET COMPANY.

Showing Latticed Construction to Stiffen the Top Flanges of the Center Sills.

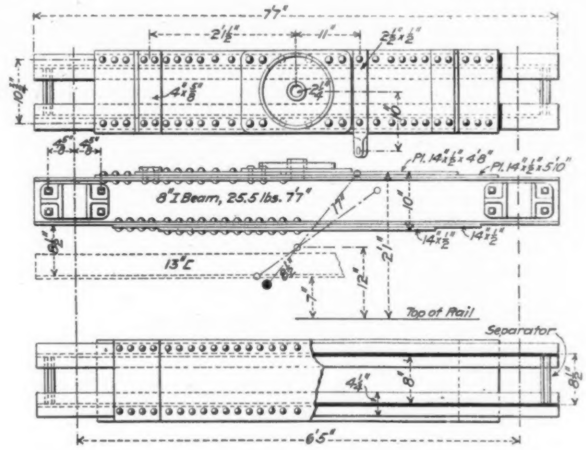
GEORGE I. KING, *Designer*. MIDDLETOWN CAR WORKS, *Builders*.

bars, thus forming a very stiff column. Truss rod struts of cast iron bear against two 10-in. I-beam cross ties, as shown; to avoid punching holes in the bottom flanges of the center and side sills, these cross ties are secured to the center sills by 9 x ½-in. steel plate brackets, the ends of which are bent up and riveted to the webs of the center sills; similar brackets ¾ in. thick are secured to the webs of the side sills and support the ends of the cross ties.

The end sill arrangement has been designed to leave this feature of the car as free as possible from connection with parts that would be difficult to remove in case of damage. It will be noted that each end sill is made of ¼-in. plate, bent to a Z shape, the top flange projecting outwardly from the car, and the bottom flange extending inwardly. Neither end sill has any connection with any frame members of the car except the side and center sills, and there is a space of ⅞ in. between the back of each end sill and the outer face of the end sheathing—this to permit moisture to drain away and prevent rotting of the end of the wooden superstructure. Each end sill is faced by a heavy cast-steel striking bracket, to the underside of which is bolted a 4 x 1-in. carry-iron for the drawbar. As the center sills are spaced 18 ins. apart with a view to using double connection angles at their ends, where they are riveted to the end sills, a twin spring draft gear was determined upon. This is of the usual type and employs the M. C. B. standard tail strap. There are four malleable-iron draft castings per car, each secured to center sills by 20 ¾-in. rivets. This underframe cannot be excelled for simplicity, durability and ease of repairs.



HALF CROSS SECTIONS AT DIFFERENT POINTS IN FLOOR OF THE CAR. SHOWING BENT PLATE CONSTRUCTION AT BOLSTER TO SUPPORT THE SIDE SILLS.




DETAILS OF THE TRUCK BOLSTERS, SHOWING SIMPLE AND STRONG CONSTRUCTION.

STEEL UNDERFRAME BOX CARS.—ILLINOIS RIVER PACKET COMPANY.

Particular attention should be given to the method of securing the wooden side sills to the steel underframe. Instead of using angles projecting outwardly from the steel sills, upon which to place the wooden sills, as is frequently done, Mr. King has used a series of bent plate Z bars, one flange of each of which is riveted to the channel side sills. The web forms a support for the wooden sill, and the other flange turns up and practically encloses it, securely locking it in position and preventing displacement sidewise even in case of failure of the frame rods, which also pass through this series of Z bar plates.

Each wooden side sill is 3⅞ x 8 ins. Between the side and each center sill are two 4 x 4-in. yellow-pine nailing strips, extending from bolster to bolster, and supported at intermediate points by a series of floor beams, consisting of 9-in. channels, 13.25-lbs. per foot, the ends of which are securely riveted to the side and center sills. It will here be observed that the center sills have been dropped 2 ins. lower than the side sills—this was done to avoid any cutting of the under surface of the floor to clear rivet heads.

The superstructure of this car is unusually heavy. The side posts and braces are 3 x 6 ins. throughout; the door posts are 6 x 6 ins.; the corner posts 5 x 8 ins.; the end posts as well as the end braces are 5 x 6 ins., while the sub-sills are 6 x 8 ins., rabbeted out to form a bearing for the floor. All post and brace pockets are provided with lips to bear against the side sills and side plates, as well as the end sub-sills and end plates. The end plates are 5 x 13 in. oak. This construction would seem to preclude any possibility of bulging at the sides, even if the car is loaded to the roof.

It will be noticed in this design that Mr. King has found it possible to use 15-in. channel center-sills extending from end to end sill, with the top of floor 4 ft. above the rail, while the outside dimensions of the car conform with the height of 12 ft. 6¾ ins. from rail and width of 9 ft. 7 ins. at eaves, recommended by the last M. C. B. Committee. This arrangement has brought the center of the draft gear almost at the neutral axis of the center sills, which is highly desirable. In order to accomplish this result a low truck is essential; the arch bar type of truck has been used, the top and bottom bars being 5 x 1¼ ins., with 5 x ⅝-in. tie bars. The wheel base is 5 ft. 6 ins. The spring plank is 13-in. channel, 35 lbs. per foot.

The truck bolster, which is shown in detail in one of the engravings, is notable for its simplicity of design, which is obtained without sacrifice of strength. As shown, it is built up of two 8-in. I-beams, 25.5 lbs. per foot, with two top covers and two bottom covers, each 14 x ½ in., riveted as closely as possible to the flanges of the beams. Malleable-iron center-plates are used and the brakes are hung to projecting arms on the truck columns. The springs used are P. R. R. standard Class H-59. One of the strongest claims for this truck, as well as for the interesting new design of underframe, is the absence of special or complicated features of construction which are costly to repair; we see no reason why this car cannot be repaired throughout by any ordinary repair shop.

Concerning the light weight of this car, which is 48,000 lbs., it should be noted that this compares favorably with the light weight of the Pennsylvania Railroad standard pressed steel underframe cars, 36 ft. long inside, as these Pennsylvania cars weigh 45,000 lbs. light. It is not believed that a thoroughly substantial steel-underframe car of 50-ton capacity, 40 ft. long, can be constructed with much less material than has been used in this design. It is a question whether a car of this size and weight would pay for general traffic where the average load might not exceed the light weight of the car.

We are greatly indebted for this information to the designer, Mr. George I. King, vice-president and general manager of the Middletown Car Works, to whom patents have been granted covering the design of the novel underframe construction.

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Overloading of engines has been carried to an extreme on some roads. Recently the writer saw a heavy train hauled over a long division by one engine which was not powerful enough to make a speed of over eight miles an hour. This train was immediately followed by a light engine which kept in sight of the heavily loaded one but did not help. This road keeps a record only of loaded trains and the superintendent has the record of his road for heavy tonnage per train. The light engine did not appear on the reports as a train. If this superintendent could have charge of a roundhouse for a short time he would know what such methods mean to the owners of the road. Officers who can not see beyond the limits of their own departments have no legitimate place in modern railroad operation. One of the best preventives of this sort of practice is a regular conference of the heads of all departments.

## EDITORIAL CORRESPONDENCE.

### IMPRESSIONS OF FOREIGN RAILROAD PRACTICE.

(*Continued from Page 7.*)

Labor, particularly unskilled, is cheap in England. In going north of London on one of the leading railroads the writer saw a rail about 75 lbs. per yard, which was being carried at a speed of about one-eighth of a mile per hour on the shoulders of as many men as could crowd together under it. There were probably 16 men under its 30 ft. of length and they walked lockstep, being so close together. It was carried in this way perhaps 200 feet along the track. The camera was not out in time or the picture would be recorded for the benefit of the reader. Imagine the adjectives which an American manager would select to express his views of such economy as this, if he should see it from the observation window of his car while on an inspection trip! Perhaps the same sort of thing will be found on the continent, but that remains to be seen.

It is not at all unusual to find a large number of men—20 or 30—handling coal at a locomotive coaling station whereas with our best appliances two men would do it all. In the hand work about the fine finish of locomotives, much labor is uneffectively employed. The locomotive supplies no legitimate opportunity for the art of draw filing, but lots of it is done here nevertheless.

Labor questions here are as important as they are at home, and this is one of the subjects most worthy of attention. Labor unions are strong and they have exerted a powerful leveling influence, which is an exceedingly important factor to be dealt with. I am told not by one but by many—and am absolutely sure of the correctness of the statement—that the lack of leadership talent here is due to the attitude of the men themselves, who do everything they can to discourage unusual efforts on the part of their fellows and prevent the discovery of those who are capable of advancement to positions of responsibility. A good man and a "duffer" works side by side and for the same wages. There is no inducement for the good man to forge ahead and get more than a "duffer's" wages. The influence is toward a very dead level and this level is that of the lazy workman. The effect is everywhere apparent in passing through the shops. This general statement is warranted, because it is confirmed by conversations with the workmen themselves. Several, with whom the writer talked openly admitted it. The least tendency toward any effort which makes a man favorably conspicuous before his superiors is frowned upon by his fellows, in the name of labor unionism. This is a grave mistake on the part of the men. A work's manager in charge of five thousand men, told the writer of cases in which good men had been disciplined in one way and another for doing more than their mates wished them to do. This condition seems to be general and not at all confined to a single road or any particular section of the country. In this respect labor unionism is a positive detriment to the advancement of the best interests of the workingmen, and it works them an injury. It does more than that—it hurts the business of Great Britain and greatly increases the cost of work, thus reflecting directly upon the best interests of the men.

With this condition combined with very high freight rates, the English railroad stockholder is in a bad way. I am told that it costs more to send certain commodities from London to Manchester, than from New York to London—3,200 miles in one case as against 180 in the other. The economical operation of locomotives here does not result in cheap freight transportation. There are other factors in the cost of transportation which must be attended to here without delay. The locomotive superintendent cannot do it all.

But with regard to the labor situation it should be said that one can see his own faults very easily when exhibited by others. It is just possible that we also are drifting very far toward the "dead level" referred to above. Workingmen cannot afford to cut off their own chances for promotion and their employers, whether in England or America, cannot afford to have them do so, as it has certainly been done here. It is exceedingly difficult to find good foremen over here and this is one reason why the railroads are so earnestly trying to improve their apprentices.

Improved methods with respect to apprenticeships constitute a subject upon which it is easy to get English motive power men to talk. They are far ahead of us in this, for they have not merely talked for a number of years about what should be done, they have really done something, and it is very interesting to find that the appreciation of this question is universal. There is not the slightest difficulty here in securing apprentices, either the so-called "workmen apprentices," "premium apprentices," or "pupils." Premium apprentices are usually sons of men outside the railroad circle, who desire shop experience and are able to pay for the privilege. They are more or less independent and are in a sense privileged characters about the shop. "Pupils" are usually college graduates who also pay premiums for the opportunity to work in the shops. They must necessarily have considerable means in order to do this. These two classes of young men have supplied some very successful railroad officers, but it may be said, speaking generally, that these forms of apprenticeship have not met the need for able managers of departments better than special apprenticeship has done on our side of the ocean. Special attention is now being given on several English railways to the workman apprentices who are sons of employees of the shops. An effort is being made to improve all of this class of apprentices by means of technical education and to develop every apprentice so that he will reveal his capabilities and enable his employers to discover the direction in which his individual ability will be most satisfactorily developed.

Mr. D. Drummond, locomotive superintendent of the London & South Western Railway, is a leader in this movement. He does not consider our special apprenticeship at all satisfactory as a means for recruiting the service with leaders of men, and while he does not disapprove of giving college men an opportunity in the shops, he considers it necessary to provide a system which will give the poor man's son an equal chance with the rich man's. He believes that the thorough shop training given the ordinary apprentice, combined with as much technical education as he can take, will supply many good men from the ranks. Considering the fact that many of the successful leaders of the past and present have come from the ranks, he has put into effect a plan whereby the apprentices attend a technical school at regular periods during working hours and at the expense of the railroad company. Last March Mr. Drummond issued the following bulletin:

LONDON & SOUTH WESTERN RAILWAY.

Locomotive Engineer's Office, Nine Elms Works,
London, S. W., March, 1903.

NOTICE TO APPRENTICES.

I am anxious that the apprentices in the L. & S. W. Ry. Works at Nine Elms should have every possible opportunity afforded them of having a scientific education, arranged to go hand in hand with their practical every-day work, and so enable them to prepare, at the end of three years, to take up the higher scientific training to be obtained at the technical colleges during the last two years of their apprenticeship. The course will commence in October and end in February.

This has been arranged to enable you to have proper time for study in the evenings, and to compare the scientific teaching you receive at the classes with the practical work going on in the workshops, so as to cultivate the habit of thinking independently for yourselves.

I have arranged for a competent teacher to give one hour, from 8 A. M. to 9 A. M., on three mornings of the week for juniors, and one hour two mornings of the week for seniors, which will form part of the day's work.

You will be expected to pass a preliminary examination in proportion, fractions, cubic and square root and mensuration, before being allowed to join the classes.

At the end of three months in each term an examination will take place to enable me to ascertain what progress has been made; the final examination to take place at the end of each term.

Those who pass the final examination will enter the higher class for the second year, and so on to the third.

Those who fail to pass the first examination, but receive from their teacher a recommendation, will have the privilege of continuing in the same class another year to give them the opportunity of passing into the higher classes.

Those who do not receive a certificate from the teacher, or who fail, at the second opportunity of passing, will have to retire from the classes.

I will arrange for those who fail not to work overtime during the winter months so as to enable them to attend evening classes if they so desire.

The apprentices who pass all their examinations satisfactorily will be allowed to attend the engineering colleges during the winter months to secure a higher education, and the time so occupied will be counted as part of their apprenticeship, and those who successfully pass the college examinations will have the privilege of entering the drawing office or the chemical laboratory during the summer months.

This privilege will continue for the last two years of their apprenticeship.

Those whose conduct is satisfactory and who have shown ability both in workshops and in technical work shall have the first call for promotion. I therefore hope that every apprentice will do his utmost to improve his knowledge and so become eligible for promotion.

Any lad whose parents have not had the means to keep him sufficiently long at school to give him an education such as would qualify him to pass the preliminary examination will call upon me, and I shall endeavor to make such arrangements as will enable him to acquire the necessary knowledge to do so.

The three subjects for the session will be "applied mechanics," "heat," and "electricity." Only one subject will be dealt with until the class is thoroughly capable of understanding it before the next is entered upon.

The directors have kindly agreed to pay the teacher's fees for the first three years. D. DRUMMOND.

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It will be impossible to discuss all of the principles involved in this plan, but the most important ones may be touched upon. This is so nearly the idea which has developed in the minds of the editor of this journal as to give him great pleasure in presenting it to those who will read these paragraphs.

Mr. Drummond wishes first to offer the boys an educational opportunity which they need; second to afford means for thoroughly sifting and sorting their capabilities in the shop and in the school; third, to encourage them to become thinkers and independent personal units in the works; fourth, to develop all as far as they can be developed, some to be merely better workmen, others to be organizers and foremen, others to go into the engineering work of the department and every one to be something that he would not be under the prevailing methods with respect to apprenticeship. He has at Nine Elms about 300 regular apprentices and 1,500 workmen in the locomotive shops. About 100 of the boys have taken advantage of his generous offer. The boys are not expected to educate themselves, after working hours, but to go when fresh from a good night's rest into the class rooms for a short time at the beginning of the day. He believes in education in direct connection with their work and he outlines the class room work to suit their needs. The instruction is given at Battersen Polytechnic School, near the works, and is under the direction of Professor Wells. Mr. Drummond watches the whole movement personally, and gives it a great deal of attention. He also considers it important that clerical positions should be filled by young men who fully understand the work of the department and expects to recruit the clerical force from apprentices. In this way he hopes to make the office more valuable in watching and checking costs and expenditures, thus rendering the office more important as a means for cheapening the cost of work. He has had years of experience with apprentices and has reached the conclusion that this plan is the very best which can be evolved.

Putting ones judgment against that of Mr. Drummond does not seem exactly modest, but nevertheless, the writer wishes to say that he hopes to see a railroad undertake this work somewhat differently. Mr. Drummond is unquestionably correct, except as to sending the boys out of the works to a school which is not specially and specifically devoted to the instruction of railroad shop apprentices. The school work is so vitally important and the apprentice is in himself such a specialty as to render it positively necessary to build up a school to fit his needs. But Mr. Drummond is actually putting his plan into effect.

Other railroads in England are occupied with this problem and further mention will be made of it in these letters.

G. M. B.

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GLASGOW, December 12, 1903.

It is decidedly shortsighted to dismiss foreign railroad practice with the remark that we have nothing to learn from it. In every department there is something to be learned and a proper study of British, German and French methods would require at least a month in each country, in addition to time spent in sight-seeing. The sight-seeing itself is good for an American, because here may be seen many works of art and many relics of by-gone ages which indicate that human nature is ever the same. The people of 3,000 B. C. had very much the same troubles that we have, and, when visiting museums and ruins and old buildings which are now in use, the questions naturally arise—Are we nowadays constructing, as a whole, anything nearly as permanent as these works of 600 to 1,000 years ago? Are our efforts of to-day as worthy of preservation in stone and steel as are these which we cross the ocean to see? Many of these remarkable works were built when wages were "a penny a day" and when engineering methods were not understood. Men in those days must have loved their work, they were so thorough. Do we love ours as well? Do we work as honestly?

These questions are strictly appropriate to a study of British railroad methods, because here people work steadily and faithfully, with but little prospect of advancement and comparatively small wages. The working people on these railroads have scarcely enough to live on, yet their faithfulness and precision of service is worthy of wide notice. In the train service this is specially apparent. These men must love their work. We could not get people to do as well as they do for any such wages, if we could get it done at all.

Competition in every direction has given Great Britain a railroad service which has no parallel elsewhere. The railroads serve the people with passenger and "goods" trains which are not equaled. No other country attempts to provide so many fast trains running long distances without intermediate stops and none provides freight service which should be classed with secondary passenger service as to celerity and certainty. Between Manchester and Liverpool, 34 miles, the Lancashire & Yorkshire runs a practically hourly passenger service with trains making the run in 40 minutes. These trains are not held out anywhere by freights and are punctual. How these people manage to do this in the midst of a congested freight district is difficult to understand until one sees the book of train schedules, which is as large, for this one small road, as our "Official Guide." Every freight is scheduled and every one is expected to run on time. The Lancashire & Yorkshire has 571 miles of line and to operate it in this way, over 800 signal towers are required. This little road runs across Great Britain and is not a trunk line. Its efficiency is remarkable. It hauls two and a half times as many passengers and nearly five times as much freight tonnage as the 3,027 miles of railroads in Ireland. Last year the Lancashire & Yorkshire handled 22,200,000 tons of freight and the Irish roads handled 5,100,000 tons. The gross earnings of this 571 miles of road last year were $45,000 per mile.

English roads were very expensively built because of the permanent character of their original construction. These comparative figures, as far as the United States is concerned, cannot be verified at the time of writing, but the comparison is something like this: The total capital of American roads is about $60,000 per mile of single track, as against $140,000 per mile in England. The comparison of expense per mile of

road for permanent way is about $1,800 per mile in the United States and $2,080 per mile in England.

Passenger business in England yields a proportion of revenue receipts in some cases nearly as great as freight. On the Lancashire & Yorkshire, in the half year ending June 30 last, the total passenger service receipts were 1,082,889 pounds sterling and the freight receipts were 1,508,647 pounds. Passenger train mileage on eleven of the most important British railroads, last year, averaged 60 per cent. of the total mileage.

English railroad efficiency is very great. The small and poorly paid staff of a large station is a source of wonder in the work done and the quiet way in which it is accomplished. Existing facilities seem to be worked to their ultimate capacity before changes are made. Because of this, extensive changes are sometimes delayed, perhaps too long.

The railroads are operated for the convenience of the people and service which we would consider extravagant is expected as a matter of course, because, through competition, the people have come to rely upon it in their business. For example, quick freight methods enables London manufacturers to compete in point of time of delivery with those of Liverpool and Manchester in goods, machinery, etc., which are to be used in Liverpool and Manchester. The goods traffic manager of one of the largest roads told the writer that between these points and London competition had compelled the establishment of a freight service which would permit a shipper in London to have goods called for at his warehouse at 6 P. M. to be delivered by the railroad delivery wagons in Manchester or Liverpool at 10 A. M. on the next day. This is an ordinary "goods" service between these and points of similar importance and at equivalent distances. No extra charge is made for such rapid deliveries and the London merchant now depends upon the railroads to put him in position to put his goods down in any part of Great Britain as quickly as they can be obtained from the nearest storehouse stock. While very convenient for the people, this is a serious problem for the railroads, and it explains many things which are not generally understood in English practice. As long as this sort of thing continues, good trains cannot be heavily loaded; they must always be fast and, to keep out of the way, they must even be accelerated above present speeds of from 30 to 40 miles per hour. It seems impossible for English railroads to delay very long in adopting electric power for everything.

In efficiency, as a whole, British railroads stand out prominently. These people get most surprising results from their inadequate facilities, but they have a difficult future to face.

The way the English people as a whole interest themselves in railroad achievements is a source of encouragement and help to those who are working out the problems. Every new locomotive design is talked about by the traveling public, and the men who produce them are looked up to. In fact, railroad officials in Europe have a high social position because of their interest. It means a lot to be a railroad officer, and it should be so.

Mention has already been made of the high standing of the motive power superintendents over here. Almost invariably in speaking of those whom they serve they mentioned the directors and not the general manager. One only referred to the manager, and, in that case, that officer is recognized generally as the ablest railroad man in Great Britain. One of our greatest needs in American railroads is a revision of the opinion in which the superintendent of motive power is held. It will come in time, but the uplifting of the American motive power official needs to be accelerated. He needs to be recognized as the most important of the subordinates of the president. He needs to be given standing and authority which will place him in position to establish a policy for his department in everything pertaining to it, and then he should be held responsible for the results. It may take some years for the necessity for this change to force itself upon our railroad stockholders, but it will come. It must come. The necessity for this is a striking result of my study abroad. Not that we have everything to learn from foreign methods, but it is perfectly apparent that the motive power departments over here are to furnish most of the advances in economy in the future. Furthermore, these motive power officers are in position to carry out all the economies which their abilities place them in position to produce. Under such circumstances a man may make a record and have all the assistance he needs to make it, and with no hindrances such as always follow placing the superintendent of motive power directly under an operating official who knows nothing about motive power matters and is not sufficiently broad-minded to let the motive power superintendent have full swing in handling his work. American railroads positively require the emancipation of the motive power departments after the manner which is general in England. We need such treatment of the heads of these departments as will make it pay the best mechanical men to enter and remain in the service. I wish it were possible for me to state this in terms as clear and positive as is my conviction on the subject.

If American superintendents of motive power had the authority of their English brothers they would save millions of dollars to their employers every year.

The writer did not pass over any road in Great Britain having as good track as that of the Lake Shore and other good American lines. The purpose of the trip was not to study track and the itinerary did not cover all of Great Britain, but it covered enough to show that we are not backward in this matter. On the leading British lines the track is usually uniformly good, but on some lines it is worse than I ever rode upon before. The spring suspension of the light English cars is very good and the track is usually in excellent surface. Whatever the shortcomings may be as to surface the spring hanging may be good enough to conceal them, but inequalities in alignment cannot be concealed by springs, and the alignment is not as good as it has been said to be. There is no hesitation whatever in making the statement that English track does not "ride" as well as the best American track, but the general average in England is better than ours. What this track would do if respectable wheel weights were used is only a matter for conjecture, and it was found that English officials in charge of track are quite willing to keep down the weights in order to maintain the track. An examination of this matter in a casual way leads to great admiration for American maintenance of way departments for what they accomplish in the face of heavy locomotives and heavy cars. It is astonishing that with the steel-tired wheels in freight equipment, as is universal practice here, the wheel loads of "wagons" should be so low. An American manager would find some way in which to increase the efficiency of these toy cars.

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The only way to give water purification a fair trial is to equip an entire division, so that certain engines may always use the treated water and not mix the good with the bad. Four roads are now preparing to do this and it is important that the necessity of this should be appreciated. Attention was directed to a case of a switch engine which with bad water required retubing every six months. This engine is now using only treated water which has been reduced from 72 to 6 grains of incrusting solids per gallon; it has been operated this way long enough to warrant the expectation of more than doubling the life of the flues. This is an excellent test but the best comparison can only be made when entire divisions are equipped. This is expensive, but it will, unquestionably, pay.

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After certain tests of abrasive wheels made at Sibley College, the metal removed was micro-photographed. The photographs, it is said, show that the metal removed by emery wheels is in the form of minute globules; that from carborundum wheels is in the shape of chips or shavings. This seems to show that an emery wheel "grinds" or wears the metal off while the carborundum wheel cuts it off in a manner much the same as a milling cutter. This is an important distinction. It not only indicates that the carborundum wheel should be the most efficient in metal removed for the same power, but that heating should be much less since it is cut off instead of being abraded by friction. The wheel that heats the least, other things being equal, should give the most accurate work.—*Machinery.*

## INDICATOR TESTS OF A LARGE TANDEM COMPOUND

ATCHISON, TOPEKA & SANTA FE RAILWAY.

Records from actual service showing the net tractive effort of large locomotives are rare, and, because these are shown and the distribution of effort from both high and low-pressure cylinders of a tandem compound, as well as the tractive effort when operating with live steam in the low-pressure cylinders, the accompanying indicator cards and data are worth preserving. These results were obtained from one of the tandem consolidation engines of the Santa Fe, built by the American Locomotive Company, and illustrated on page 179 of our June number, 1902. In order to ascertain the actual capacity of these engines, one of them was indicated on the Albuquerque division in February last, and from the cards taken four are selected for reproduction.

By applying the usual formulae, a tractive effort of 41,024 lbs. would be expected. By actual test, allowing 8 per cent. for internal friction, the tractive effort, operating as a compound, averages 41,000 lbs. At 11 miles per hour—card No. 10—the effort was 31,315 lbs. In the work done by the high and low-pressure cylinders there is a rather large difference, but with the tandem arrangement this should not cause any difficulty. The figures show the proportion of work done in each cylinder and the additional effort made possible by simple working. For convenience a diagram of the engine and some of the principal dimensions are presented. We are indebted to Mr. R. S. Wickersham, assistant engineer of tests, and Mr. G. R. Joughins, mechanical superintendent, of the Santa Fe Coast Lines, for this interesting record.

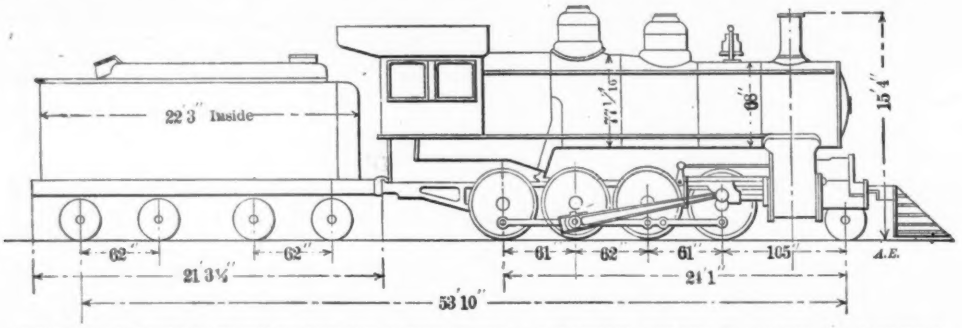



DIAGRAM OF THE TANDEM-COMPOUND LOCOMOTIVE.—ATCHISON, TOPEKA & SANTA FE RAILWAY.

TANDEM COMPOUND LOCOMOTIVE.

2-8-0 Type Atchison, Topeka & Santa Fe Railway.

| | |
|---|---|
| Cylinders | 16 and 28 x 32 ins. |
| Driving wheels, diameter | 57 ins. |
| Boiler pressure | 210 lbs. |
| Weight on drivers | 176,000 lbs. |
| Weight, total | 201,000 lbs. |
| Heating surface | 2,965 sq. ft. |
| Grate area | 50 sq. ft. |

(For other dimensions see AMERICAN ENGINEER, June, 1902, page 179.)

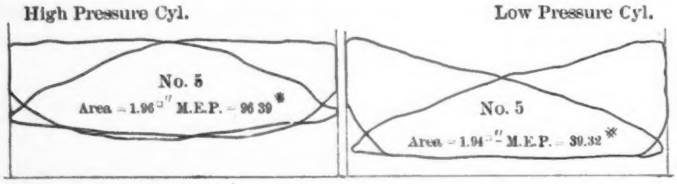
The summary of results and data for the indicator cards are given in the accompanying tables.

TANDEM COMPOUND CONSOLIDATION ENGINE NO. 861.—February 28, 1903.—Tonnage = 1,020.

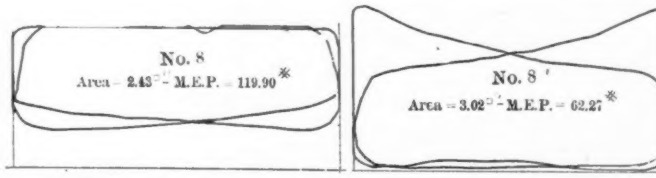
| No. of Card. | Engine Conditions. Speed in M.P.H. | Engine Conditions. Boiler Pressure in Lbs. Per Sq. In. | M.E.P. High Pressure Cylinder. Lbs. | M.E.P. Low Pressure Cylinder. Lbs. | Tractice Force. Power Devoloped on One Side. High Pressure Cylinder. | Power Devoloped on One Side. Low Pressure Cylinder. | Power Devoloped on One Side. Total. | Grand Total. | Net. T. F. at rim of wheel, allowing 8 per cent. reduction for internal friction, etc. Engine Working. Compound. | Engine Working. Simple. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 200 | 8,669 | 71.92 | 6,229 | 15,827 | 22,056 | 44,112 | ...... | 40,583 | |
| 2 | 6 | 200 | 120.00 | 56.96 | 8,623 | 12,535 | 21,158 | 42,316 | 38,931 | ...... | |
| 3 | 10 | 205 | 87.95 | 67.50 | 6,320 | 14,855 | 21,175 | 42,350 | ...... | 38,962 | |
| 4 | 12 | 205 | 125.00 | 59.80 | 8,983 | 13,160 | 22,143 | 44,286 | 40,743 | ...... | |
| 5 | 18 | 205 | 96.39 | 39.32 | 6,927 | 8,653 | 15,580 | 31,160 | 28,667 | ...... | Second notch below one-half stroke |
| 6 | 5 | 198 | 125.41 | 60.20 | 9,012 | 13,248 | 22,260 | 44,520 | 40,958 | ...... | |
| 7 | 6 | 198 | 77.21 | 94.73 | 5,548 | 20,847 | 26,395 | 52,790 | ...... | 48,567 | |
| 8 | 5 | 195 | 119.90 | 62.27 | 8,606 | 13,704 | 22,310 | 44,620 | 41,050 | ...... | |
| 10 | 11 | 205 | 103.13 | 43.66 | 7,411 | 9,608 | 17,019 | 34,038 | 31,315 | ...... | Fifth notch below one-half stroke |
| 11 | 4 | 205 | 89.21 | 94.95 | 6,411 | 20,896 | 27,307 | 54,614 | ...... | 50,225 | |
| 12 | 6 | 200 | 120.70 | 64.44 | 8,674 | 14,181 | 22,855 | 45,710 | 42,053 | ...... | |
| 13 | 3 | 205 | 74.75 | 102.70 | 5,336 | 22,601 | 27,937 | 55,874 | ...... | 51,404 | |
| 14 | 4 | 200 | 123.00 | 67.07 | 8,839 | 14,760 | 23,599 | 47,198 | 43,422 | ...... | |
| 15 | 6 | 200 | 83.72 | 96.30 | 6,016 | 21,193 | 27,209 | 54,418 | ...... | 50,065 | |
| 16 | 4 | 203 | 121.91 | 66.91 | 8,760 | 14,725 | 23,485 | 46,970 | 43,212 | ...... | |

All cards taken with full throttle and reverse lever in corner, except four, which were half throttle, with cut-off as shown under "Remarks."

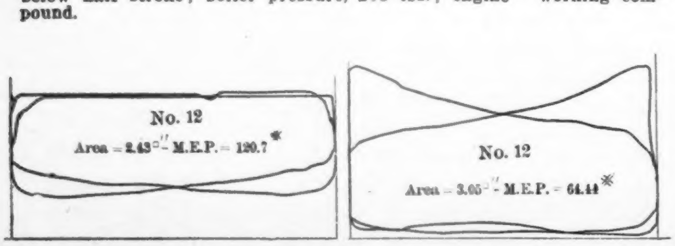
High Pressure Cyl. Low Pressure Cyl.



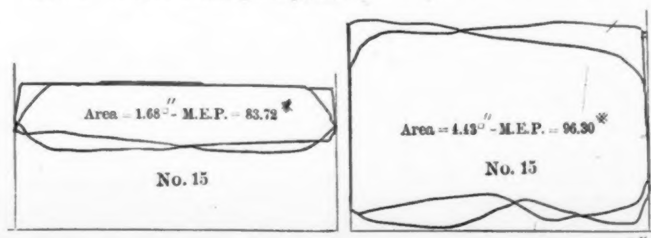

No. 5—Speed, 18 m. p. h.; throttle, half open; cut-off, second notch below half stroke; boiler pressure, 205 lbs.; engine working compound.




No. 8—Speed, 5 m. p. h.; throttle, full; cut-off, full; boiler pressure, 195 lbs. Engine working compound.




No. 12—Speed, 6 m. p. h.; throttle, full; cut-off, full; boiler pressure, 200 lbs. Engine working compound.




No. 15—Speed, 6 m. p. h.; throttle, full; cut-off, full; boiler pressure, 200 lbs. Engine working simple.

TRACTIVE FORCE SUMMARY.

Approximate Average Tractive Force Developed. Engine 861.

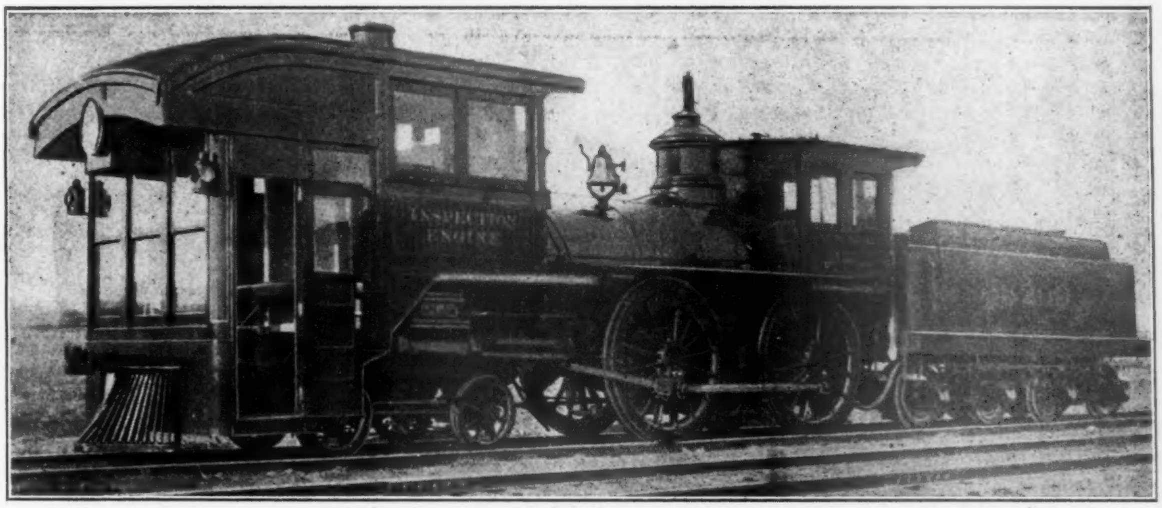
| | High Pressure Cylinder. | Low Pressure Cylinder. | Net Total. |
|---|---|---|---|
| Engine working Simple | 5,828 | 21,384 | 50,070 |
| Engine working Compound | 8,870 | 13,688 | 41,507 |

Percentage of Total Tractive Force Developed in Each Cylinder.

| | High Pressure Cylinder. | Low Pressure Cylinder. |
|---|---|---|
| Engine working Simple | 21.4% | 78.6% |
| Engine working Compound | 39.3% | 60.7% |

Comparison of Tractive Force Developed in High and Low Pressure Cylinders Using High Pressure Cylinder as a Basis.

| | High Pressure Cylinder. | Low Pressure Cylinder. |
|---|---|---|
| Engine working Simple | 100% | 366.9% |
| Engine working Compound | 100% | 154.3% |



VIEW OF THE NEW DESIGN OF INSPECTION LOCOMOTIVE.—BURLINGTON & MISSOURI RIVER RAILROAD.

## NEW INSPECTION LOCOMOTIVE.

BURLINGTON & MISSOURI RIVER RAILROAD.

A photograph of this unique inspection locomotive is reproduced by the courtesy of Mr. R. D. Smith, superintendent of motive power of this road. The locomotive is an old one of the 4-4-0 type with the observation cab built over the front end and extending back of the stack sufficiently to secure good anchorage and satisfactory balance. The observation cab is built upon steel plates which are securely fastened to the front frames of the engine. To these the woodwork and framing are secured.

By bringing the front of the cab low with respect to the track the inspecting officer is enabled to closely observe the condition of the track when running slowly. Seating capacity for seven is provided in the observation space in front, while five more are comfortably accommodated in the upper part, through which the stack passes. By lagging the entire front end and stack with magnesia and leaving air space for insulation, the entire observation space is made quite comfortable for summer use; in the winter it is heated by means of steam coils.

Longitudinal seats are provided in the upper room and also a folding seat for the conductor, for use when necessary. In the observation room the seats are very conveniently and advantageously arranged in two tiers.

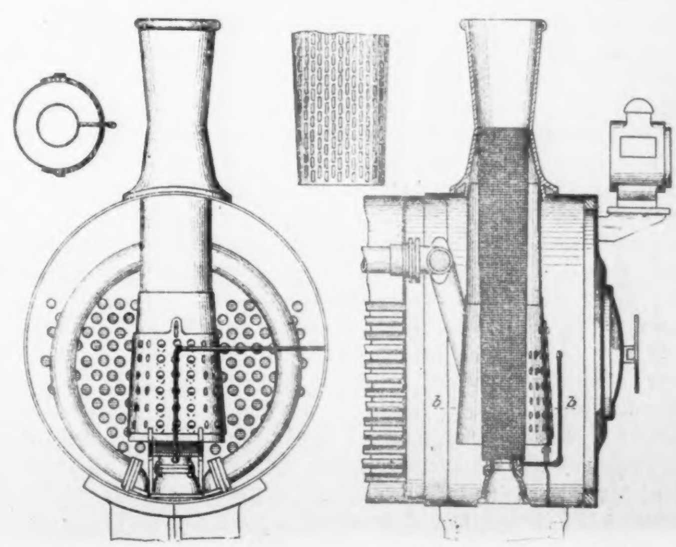
This locomotive is controlled, except as to the reverse lever, by the person sitting in the front seat. He has the throttle, air brake valve, whistle and bell at his command, so that the inspecting officer may himself run the engine. The fireman tends the reverse lever, the fire and water. The engine has an electric headlight and incandescent lamps in the cabs. The observation cab is provided with hot and cold water in overhead tanks and a folding wash basin as well as a clothes cupboard.

Mr. Smith reports the engine to be very satisfactory. The details are very nicely worked out.

## KALBAUGH'S ARRANGEMENT OF LOCOMOTIVE FRONT ENDS.

Through the courtesy of Mr. I. N. Kalbaugh, superintendent of motive power of the West Virginia Central & Pittsburgh Railway, the drawing of a new front end arrangement, devised and patented by him, has been received. While some of the elements of this construction have been used before, the combination is new, and it has given excellent results in service. The stack is tapered and the spark netting is in the form of a very long truncated cone reaching from the nozzle tip to the choke of the stack. Instead of the usual diaphragm plate a conical hood is employed, which surrounds the netting and the draft effect is adjusted by means of the sliding plate in front of this hood.

The perforations in the cone are 3-16 by 1½ in. The engines fitted with this device emit quite a number of small sparks, but because of their small size they are not objectionable and a smaller opening in the netting does not seem to be necessary. This locomotive has 22 by 28 in. cylinders and a 5 in. exhaust nozzle. With very poor, small vein coal the locomotives steam freely, and this is very difficult with the usual construction of front ends with this fuel. Mr. Kalbaugh has found a marked saving in fuel as a result of the application of this arrangement in the smoke box, and is applying it to a number of locomotives.



KALBAUGH'S ARRANGEMENT OF LOCOMOTIVE FRONT ENDS.

## THE APPLICATION OF INDIVIDUAL MOTOR DRIVES TO OLD MACHINE TOOLS.

McKees Rocks Shops.—Pittsburgh & Lake Erie Railroad.

BY R. V. WRIGHT, MECHANICAL ENGINEER.

VII.

### RADIAL DRILL PRESS.

Figures 32, 33, and 34 illustrate an interesting motor application to an old Niles radial drill, with a 6-ft. arm which had been in service at the old locomotive shops of this system at McKees Rocks. Its condition seemed to warrant the change in the diagram, which can be thrown in mesh with a gear keyed to the same shaft as gear, 3, at will.

The bracket which carried the two speed cones was not suitable for supporting the motor. However, in order to use a single motor for driving the tool and for raising and lowering the arm, and, in order to use two runs of gearing and thus allow the use of a comparatively small motor, a new bracket to replace the old one would have had to be of a rather intricate design. Since there was only one tool of this design to be changed, it was thought best to attach the motor to the bracket by means of wrought iron braces and to strengthen the bracket with a wrought iron strap, in the manner indicated in the accompanying drawings.

Referring now to Figs. 34 and 35, and comparing them, it

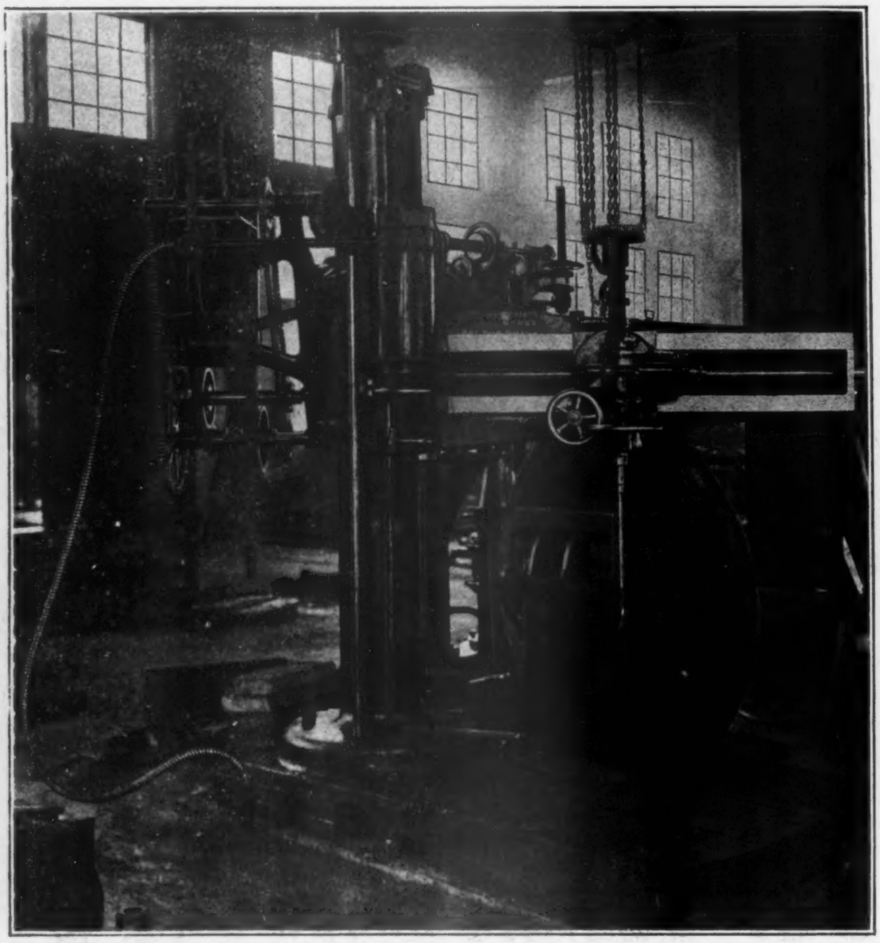


FIG. 32.—GENERAL VIEW OF THE NILES RADIAL DRILL AS EQUIPPED WITH THE INDIVIDUAL MOTOR DRIVE. CROCKER-WHEELER MOTOR AND CONTROLLER. MCKEES ROCKS SHOPS.—PITTSBURGH & LAKE ERIE.

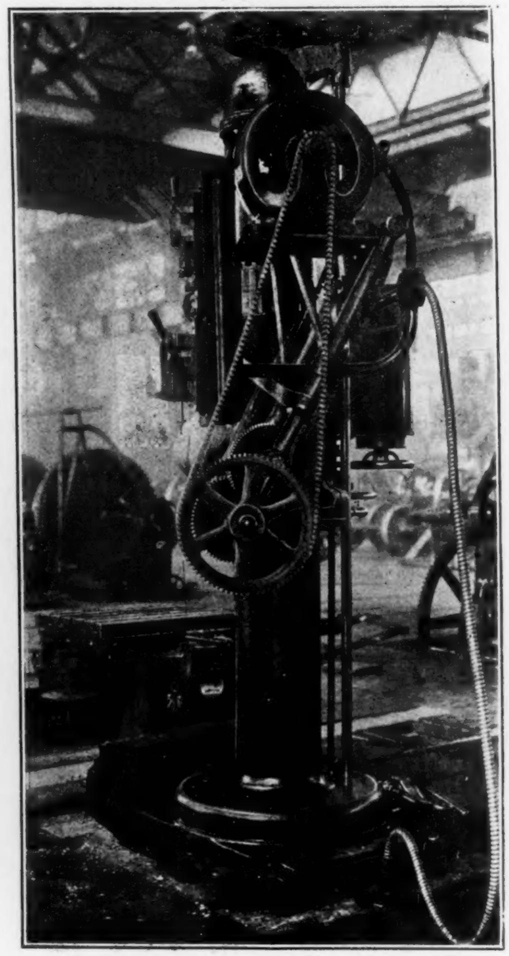


FIG. 33.—REAR VIEW OF THE DRILL, SHOWING METHOD OF MOUNTING THE MOTOR UPON THE BRACKET.

its equipment for individual driving, which was carried out as here indicated.

In order to more fully understand this application, and to get some idea of the comparatively small amount of work and material which were required in this case to change over from the belt drive, reference may be made to Fig. 35, which is a diagram showing how the tool was driven originally with the belt drive.

This drill is of the usual style with the arm, which carries the drill spindle, arranged to swing about the column, and on the opposite side of this column from the arm, and bolted to the arm casting where it embraces the column, is a bracket which previously carried the two speed cones and the gears as designated on the diagram. Gears 4 and 5 and the spline shaft, (see Fig. 35), were arranged to swing with the arm, and as gear 3, which is carried on top of the column, is concentric with the column, gear 4 keeps in mesh with it as the arm is revolved. As the arm is raised or lowered, gear 5, slides on the spline shaft and keeps in mesh with gear 6. A separate shaft which operates the mechanism for moving the arm up or down on the column has at its upper end a gear, not shown on will be seen that in order to apply the motor the lower speed cone, 8, was removed and replaced by a double clutch and gears A and D. Gear A, is cast solid on a sleeve which projects through the bearing in the bracket and far enough beyond it to carry the large sprocket, F, which is connected to the pinion on the motor by means of a 1¼-in. Morse silent chain. A cast iron gear sleeve, C, was placed on the back shaft to which the gear, B, is keyed, this sleeve being rotated by gear, B, meshing with driving gear A. The two runs of gearing for the spindle drive are here provided, one by throwing clutch, K, directly in clutch with A, and the other by clutching with gear D, D being driven from A through the large speed reduction. The clutch, K, is splined on the lower shaft which extends out on the arm and drives the spindle. The drawing of details, Fig. 36, shows the details of the above-mentioned sleeve carrying gear, A, and to which sprocket, F, is keyed, and also the gear sleeve, C, which rotates on the back shaft. The details of the lever and latch plate for use in operating clutch, K, are also made clear in this view.

On the back shaft sleeve, C, the silent chain sprocket, G, is also keyed. The upper speed cone, 7, was replaced by the

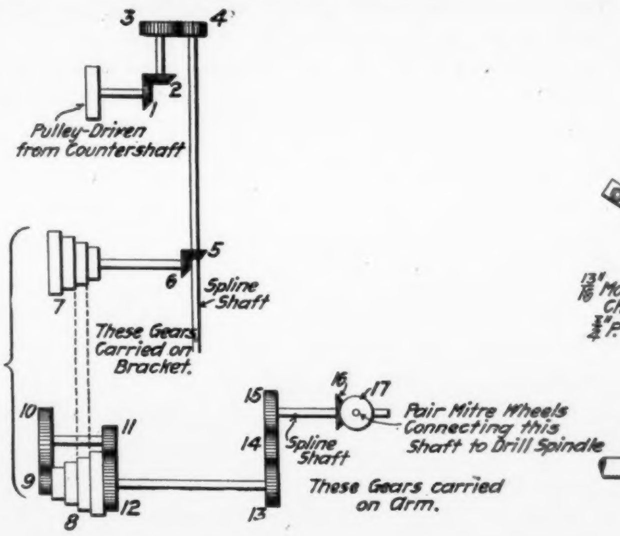



FIG. 34.—DIAGRAM OF THE ORIGINAL ARRANGEMENT OF THE DRIVE WITH THE CONE PULLEYS CARRIED ON THE BRACKET AT THE REAR OF THE ARM.

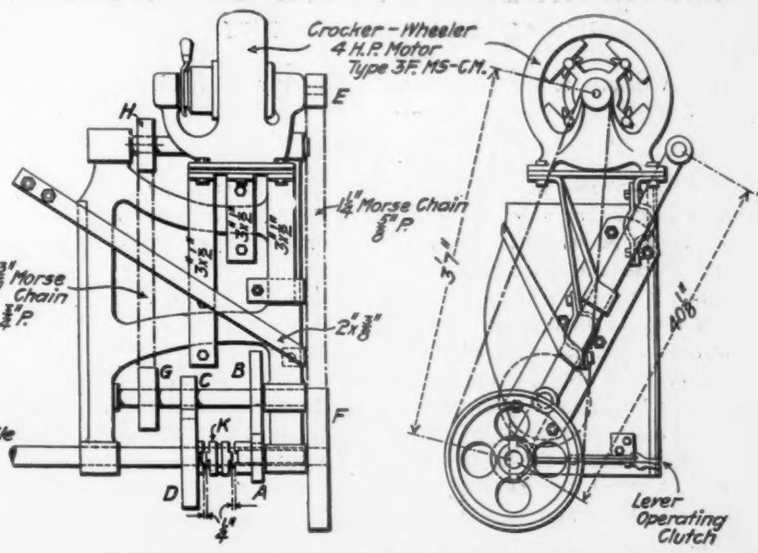



FIG. 35.—DETAILS OF THE APPLICATION OF THE MOTOR DRIVE, SHOWING METHOD OF MOUNTING THE MOTOR UPON THE BRACKET BY MEANS OF THE WROUGHT-IRON PLATE AND STRAPS.

sprocket, H, which is keyed to the upper shaft, and is driven from the sprocket, G, by a 13-16-in. Morse silent chain and which in turn drives gears 6, 5, 4, 3 and the gears which control the mechanism for raising and lowering the arm. By running the motor at a high speed the arm can, in this way, be moved up or down at fair rate.

This tool has been running with this arrangement of motor driving for some time and except when the drill is rotating at a very high speed and cutting, there is practically no vibration of the motor and bracket, and even then the vibration is hardly noticeable.

As will be seen by referring to Fig. 32, the controller is attached to the arm casting at the column within easy reach of the operator, and as it revolves with the arm, it is always in the same relative position as regards the work. The panel which carries the switches, circuit breaker, etc., is attached to the motor braces at the rear, and while out of the way, is easily accessible. The wires are carried from the wire box underneath the floor by means of flexible tubing conduit as shown in the views. This tool is equipped with a type M. F.-21 multiple-voltage system controller and the type 3 F., M S., C. M. variable speed motor, to develop 4 horsepower at 240 volts, built by the Crocker-Wheeler Company.

The range of spindle speeds and the power provided throughout are the same as for the vertical drill presses described in the fifth article of this series (see pages 441-2, December, 1903, issue), and the diagram shown on Fig. 25 of that issue shows the variations of power at the various speeds. Because of the large number of speed steps provided and because of the ease with which speed can be changed, the efficiency of this tool has been considerably increased by the application of the variable speed motor.

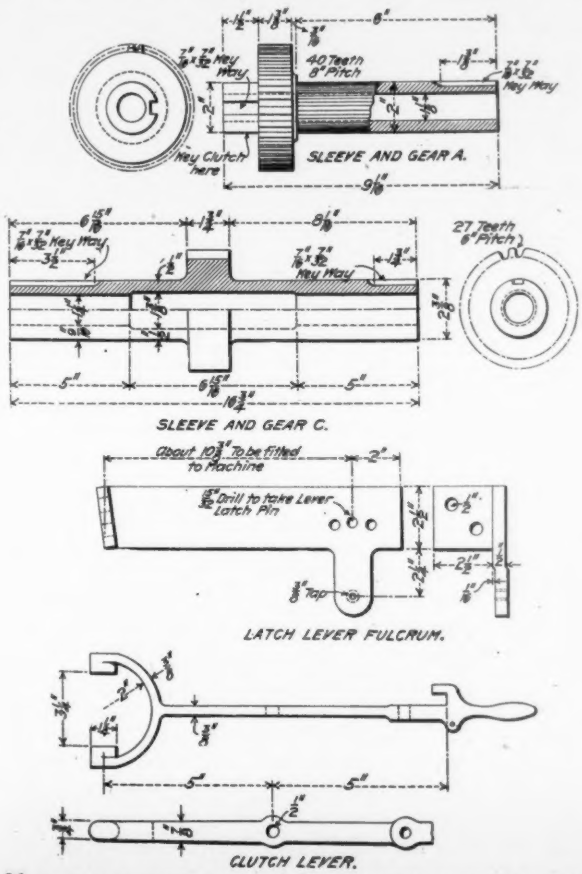



FIG. 36.—DETAILS OF THE NEW PARTS REQUIRED FOR THE NEW MOTOR DRIVE, TO FURNISH TWO CHANGES OF SPEED BY GEARING.

NOTE.—Inadvertantly the last sentence of the preceding article of this series (see page 15, January, 1904, issue) was made to read somewhat indefinite. The concluding statement: "although the latter type furnishes a somewhat greater speed range than is necessary for these tools," would tend to indicate that the type M. F.-21 controller of the Crocker-Wheeler Company was more elaborate than was necessary in this case. The fact, is, however, that the drive for this machine had been designed for a M. A.-12 controller (the type using armature resistance for the intermediate speeds) and all the materials, sprockets, chain, etc., ordered before it was decided to use the M. F.-21 type of controller. Since the M. F.-21 allows a higher motor speed than the M. A.-12, it was found necessary to cut out the three highest steps so as not to run the ram of the slotter too fast. If it had been decided to use the M. F.-21 controller in the first place, a greater speed reduction from the motor to the tool would have been made, and by being able to use the highest points on the M. F.-21 controller, a higher average power would have been available throughout the working speed range of the tool, than with the M. A.-12, or, in other words, a higher voltage could be used to obtain the same speed with the M. F.-21 than with the M. A.-12 type of controller.

Mr. T. S. Reilly, associate editor of the Railway and Engineering Review, has been appointed superintendent of the railway division of the department of Transportation Exhibits at the Louisiana Purchase Exposition, and has assumed the duties of the position. Mr. Reilly learned the machinist's trade before going to college, where he graduated in civil engineering, after which he spent some time on various railways as machinist, fireman and draughtsman. Recently he has been mechanical editor of the Railway Review; in charge of dynamometer car tests W. A. B. Co.; master mechanic C. C. C. Co.; road foreman of equipment and then master mechanic of the Frisco system.

## RAILROAD SHOP MANAGEMENT.

BY WILLIAM S. COZAD, NORFOLK & WESTERN RAILWAY.

III.

It is the purpose of this article to present, in detail, a systematic method of time keeping and accounting for railway repair shops in which a part of the labor performed is paid for on the basis of piece rates.

In every piece-work shop, no matter how extensively the system may be introduced, there is a certain portion of the labor that must be performed on a shop time basis and any system of time keeping introduced into such a shop must be sufficiently broad to properly account for both classes of time. It should also be emphasized here that methods of accounting for labor performed should be applied with special reference to the way in which the work is carried on in the shop, instead of requiring shop methods to conform to any system of time-keeping.

The system described in this paper is handled entirely, with the single exception of the time book, by the use of cards made of a very cheap grade of thin cardboard, and in point of first cost of stationery will be found much less expensive than many of the methods now in use. The size of these cards is 4½ by 9 ins. and with slight modifications, they can be applied equally as well to shops run entirely on a day work basis as in shops where part of the labor is performed on piece-work.

Fig. 1 represents what is termed the Employee's Daily Check card, and is intended to form a record of the time when each workman enters the shop, both in the morning and after the

A. B. C. RAILWAY COMPANY.

EMPLOYEE'S DAILY CHECK CARD.

............................Shop. Date........ *11/4*............

| Number. | Charge. | | Hours. | | Commenced work. | |
|---|---|---|---|---|---|---|
| | A. M. | P. M. | A. M. | P. M. | A. M. | P. M. |
| *350* | *310* | *310* | *5* | *5* | 7 | 6 |
| *400* | | | | | 7 | 6 |

(This form to contain 20 blank lines.)

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |

Correct.........................................., Shop Foreman.

FIG. 1.

noon hour. On entering the shop in the morning each workman is required to pass the shop office or some other convenient place, which may be arranged by the general foreman, and call a number which has previously been assigned to him, and which must agree with his number on the card case (which will be described hereafter, Fig. 9). His number will be recorded in the column headed "number"; in the column headed "commenced work" should be recorded the time at which each employee enters the shop, all workmen entering before the whistle blows being registered at the hour adopted by the shop to begin work, but any entering after this time being required to see the time keeper, who will register his number and the time he enters the shop in red ink on the record card. Any employee failing to call his number, or failing to have his number and time registered when entering late, should be liable to loss of all time for that half day, subject to the discretion of the foreman.

The two columns headed "*charge*" and "*hours*" are to be used only by those who work on shop time and whose time is chargeable to specific items, such as engines, cars or special accounts. When calling their number upon entering the shop at 1:00 P. M., workmen may report the charge for the work done during the preceding half day, which should be entered in proper columns along with the hours worked. Before work closes in the evening, the clerk having charge of the daily check cards, should go out through the shop, ascertain from each workman who is paid by the hour what his time should be charged to for that half day and make proper record on the card. This card should then be carefully checked by the gang foreman and foreman, and turned in to the time keeper to be recorded on the Daily Shop Time Service card.

Fig. 2 represents the next card in order which is the Daily Shop Time Service card and covers shop time only. These cards should be printed with thirty-one spaces representing

A. B. C. RAILWAY COMPANY.

DAILY SHOP TIME SERVICE.

OF *Wm. Jones.* NO *350.*

*Machine* SHOP. *November,* 1903.

| Date. | Charge. | Commenced work. | Finished work. | Hours. |
|---|---|---|---|---|
| *11/4* | *E 310* | *7 A. M.* | *6 P. M.* | *10* |

(This card to contain 31 blank lines.)

| | | | | |
|---|---|---|---|---|
| | | | | |
| | Total hours.. | ............ | ............ | *10* |

Total hours. *10.* Rate. *$1.25.* Amount, *$1.25.*

Correct, *J. A. Jensen,* Shop Foreman.

FIG. 2.

thirty-one days. For all laborers and men whose time each day is chargeable to the same account one card will answer for the entire month. When the time of any workman is chargeable to a number of different jobs, these Daily Time Service cards, when full, must be totaled and entered in the time book and new ones started, which, when full, will be again entered in the time book, and so on to the end of the month. Fig. 3 is the opposite side of the card shown in Fig. 2, and is designed to record all overtime made by the regular day workman whose name appears on the other side.

A. B. C. RAILWAY COMPANY.

RECORD OF OVERTIME SERVICE OF PERSONS NAMED ON OTHER SIDE OF THIS CARD.

| Date. | Charge. | Commenced work. | Finished work. | Hours. |
|---|---|---|---|---|
| *11/4* | *E 310* | *7 P. M.* | *9 P. M.* | *3* |
| | | | | |

(This card to contain 31 blank lines.)

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | Total hours.. | ............ | *3* |

Total hours, *3.* Rate, *$1.25.* Amount, *0.37.*

*J. A. Jensen,* Shop Foreman.

FIG. 3.

Figs. 4 and 5 represent opposite sides of another card, which is used by piece-workers only and is handled exclusively by the piece-work inspector and approved by the foreman. On the front side of this card (Fig. 4) is shown the name and number of the workman, or the leader of gang, if two or more men are working on the same job. This card is so arranged as to furnish a means of recording, in a very condensed form, the information contained in the piece-work schedule, and in order to use it to best advantage, the piece-work schedules should be made in duplicate on a mimeograph and copies placed at different points in the shop where the employees may have ready access to them. The piece-work schedule for each shop (see Fig. 8) should be designated by some letter of the alphabet so

Card No. *1.*

A. B. C. RAILWAY COMPANY.

PIECE-WORK RECORD CARD.

OF *Frank Carper.* NO. *400.*

| Charge. | Schedule number. | No. of pieces. | Price per piece. | Amount. |
|---|---|---|---|---|
| *E 310* | *M 500* | *1* | *$ .75* | *$ .75* |
| *E 310* | *501* | *4* | *.30* | *1.20* |
| *E 310* | *502* | *2* | *1.75* | *3.50* |
| *E 850* | *502* | *3* | *1.75* | *5.25* |
| *E 75* | *500* | *4* | *.75* | *3.00* |
| | *501* | *4* | *.30* | *1.20* |
| | | | | |
| | | | | |
| | | | | *$14.90* |

Rates and Calculations Checked by

Work authorized and done, *J. H. Pattison,* Foreman.

FIG. 4.

DAILY TIME CERTIFICATE.

| Number. | Names of Workmen. | Date. 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | Total hours. | Rate. | Amount. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *400* | *F. Carper.* | Hours. | | | *10* | *10* | *10* | | | | | | | | | | | | | | | | | | | | | | | | | | *30* | *30c* | *$14.90* |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Total..... | | *$14.90* |

Fig. 5—(Opposite Side of Card Shown in Fig. 4).

that cards from the different departments can be readily distinguished, and each operation in the schedule should be preceded by a number and the schedule letter.

In making a record of the time, the piece-work inspector will take from the filing case the cards he may wish to use, and after carefully inspecting the work, will enter on the card the charge, schedule number, number of pieces, price per piece and total amount. This should always be done in the presence of the workmen, so that any mistake may be avoided, and also so that the workmen may, if he desires to do so, make the same record in his memorandum book which he may provide for the purpose.

When the face of this card (Fig. 4) is full the column headed "amount" should be totaled and carried forward to the top of the same column on the card shown in Figure 6. This card (Fig. 6) is printed on one side only and may be added to the side of card shown as Fig. 4, one after another until the end of the month; or when two or more men are working together and it becomes necessary to separate the gang, then the cards must be closed, proper division of the money made, and the

A. B. C. RAILWAY COMPANY.

TIME BOOK.

Name, *Frank Carper.* Occupation, *Machinist.*

| Date. | Card number. | Hours. | Rate. | Amount. |
|---|---|---|---|---|
| PIECE-WORK. | | | | |
| *11/6* | *1* | *30* | *$3.00* | *$14.90* |
| | Total | | ..... | *$14.90* |
| SHOP TIME. | | | | |
| | | | | |
| | Total | ..... | ..... | ...... |

Name, *Wm. Jones.* Occupation, *Laborer.*

| Date. | Card number. | Hours. | Rate. | Amount. |
|---|---|---|---|---|
| PIECE-WORK. | | | | |
| | | | | |
| | Total | | | |
| SHOP TIME. | | | | |
| *11/5* | *350* | *13* | *$1.25* | *$1.63* |
| | Total | ..... | ..... | *$1.63* |

FIG. 7.

| Charge. | Schedule number. | No. of pieces. | Price per piece. | Amount. |
|---|---|---|---|---|
| | | | | |
| | | | | |
| (This card to contain 30 blank lines.) | | | | |
| | | Total..... | ..... .... | ...... |

FIG. 6.

hours worked and money earned by each man entered in the time book (Fig. 7). Fig. 5 is the opposite side of the card shown in Fig. 4, and is desiged to keep the time of the men whose names appear thereon while working on piece-work only.

If a workman is changed from piece-work to shop time at any time within the day, the time at which the change is made must be authorized by the foreman or piece-work inspector, and the inspector will then make a note of the number of hours worked shop time and insert the proper charge on the Daily Shop Time Service card (Fig. 2), and send that card to the foreman's desk, who will note and, if correct, place the same in the case.

Fig. 7 represents a sample page of the time book and is plain enough to require but little explanation. It should be understood, however, that all piece-work cards bear a local number at the upper right hand corner (see Fig. 4), which has no relation whatever to the number of the workman, but serves to designate the card after it is placed in the case in one of the pockets marked 100, 200, etc. When piece-work cards are entered in the time book they should be entered under their card number and with no reference to the number of the workman, and where two or more men are working together and are shown on the same card, each should be entered under the same card number. Then if it becomes necessary to refer back to the card, it can be easily located.

At the end of the month all cards should be closed, the time entered in the timebook, after which they should go to the distribution clerk; after the distribution has been made, the cards should be returned to the time-keeper's office. When payment has been made for the time covered by the cards for any one month and the errors, if any, corrected, they can then be placed in permanent file in the card record case.

Fig. 8 is a sample leaf of the Machine Shop Piece-Work Schedule, and is submitted so that the illustrations of the cards will be complete.

A. B. C. RAILWAY COMPANY.

PIECE-WORK SCHEDULE, MACHINE SHOP.

EFFECTIVE, DECEMBER 1, 1903.

| Schedule number. | Operation. | Price. |
|---|---|---|
| M500 | Driving axle centered, faced on ends and rough cut, all work, job complete, each. | $ .75 |
| M501 | Driving wheel tire, 60-in., bored to fit wheel center, each. | .30 |
| M502 | Driving wheels, old, put in lathe and tires turned complete, includes all work from start to finish, per pair | 1.75 |

FIG. 8.

*(To be continued.)*

## A SHOP SCHEDULE FOR LOCOMOTIVE REPAIRS.

CHICAGO & NORTHWESTERN RAILWAY.

Through the courtesy of Mr. Robert Quayle, the schedule for locomotive repairs at the Chicago shops of the Chicago & Northwestern is presented. This plan was developed by Mr. G. R. Henderson when assistant superintendent of motive power of that road, assisted by Mr. O. Otto, general foreman at Chicago. It is part of a plan which has been found very beneficial, and has introduced an element of commercial spirit into the work which is not too often seen in railroad shops.

In order to provide repair material without delay, each division master mechanic keeps a card record for each engine, with a statement of the kind of service and mileage made since the previous shopping. Ninety days before an engine is to go to the Chicago shops (where all heavy repairs are made) its card is sent to Chicago and the repair material is ordered. The engine is ordered to the shop at the expiration of this period, and this occurs usually after having made from 150,000 to 200,000 miles. These cards contain a concise record of each engine and its location and service after leaving the shops.

Nearly all repair work, except on wrecked engines, may be covered by three classes: 1. General repairs, including a new firebox or half side sheets, combined with a back flue sheet or a new crown sheet. This requires 24 shop days. 2. General repairs, with half side sheets, requiring 21 days; and 3. Light repairs, involving easy boiler work, and requiring but 8 days.

The 21 and 8-day schedules are presented here to indicate the business-like way of handling the work in the various departments. Each line of the schedule has a date, and the entries under each department heading indicate the dates upon which each part of the work must be ready for the work of the next department. For example, the boiler goes to the erecting shop on the fourteenth day. At that time the brakes, valves, frames, driving wheels, driving boxes, springs, etc., are all ready for the erecting shop. The other parts are brought in, the tender completed, and a day is allowed for finishing up after the valves are set. The work on the 21 pits is handled by 4 gangs.

Each foreman has these schedules mounted in permanent form, and a slip is provided for each engine in the shop. These slips are dated and held upon the schedule by a spring clip. They are ruled in columns, for the different grades of repairs. In this way each foreman knows exactly when each part of each engine must be ready.

The weekly record contains the information required by the general foreman, giving at a glance all of the work in the shop and the engines turned out during the current month. Thus the report for the last week of the month gives the output for the entire month. A part of the plan is to hold a meeting of the foremen every week to discuss the subject of the work in hand and the reasons for such delays as may occur. In such a scheme as this, wrecked engines present a difficulty which cannot be provided for by any schedule. Smooth working of schedules is also upset by discovering defects which are not revealed until an engine is stripped. These cases, however,

ENGINES IN SHOP.

WEEK COMMENCING......................190..

| GANG I. | | | | | GANG II. | | | | | GANG III. | | | | | GANG IV. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Engine No. | Div. | Date in | Repairs | Date out | Engine No. | Div. | Date in | Repairs | Date out | Engine No. | Div. | Date in | Repairs | Date out | Engine No. | Div. | Date in | Repairs | Date out |
| | | | | | | | | | | | | | | | | | | | |

OUTPUT MONTH OF......................................

NOTE.—Under this heading is placed a record of the locomotives turned out each week.

SCHEDULE OF WORK FOR ENGINE NO —— GENERAL REPAIRS AND HALF SIDE SHEETS OR FIREBOX.

| Date. | Erecting Shop. | Boiler Shop. | Machine Shop. | Smith Shop. | Tank Shop. | Carpenter Shop. | Paint Shop. |
|---|---|---|---|---|---|---|---|
| | Engine taken in. | | | | | | |
| | Stripped and to boiler shop. | Boiler in shop. | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | Valve yokes. | | | |
| | | | | Brake work, frames. | | | |
| | Cylinders bored. | | | Tender springs. | Trucks completed. | | |
| | | | Brakes, valves and yokes. | Rods and straps. | Frame completed. | Cab repaired. | |
| | | | | | Tank repaired. | Tender work. | |
| | Steam chests and valves up. | | | Guides and yokes. | Tender completed. | | |
| | | | Frames finished. | | | | |
| | | Firebox repaired. | Driving boxes fitted driving wheels ready, shoes and wedges. | Spring rigging. | | | |
| | Boiler returned. | Boiler to erecting shop. | Eccentric straps and rods. | Truck springs. | | | Cab painted. |
| | Frames up, steam pipes in. | | Cross heads and guides. | Driving springs. | | Back running boards up. | Wheels painted. |
| | Truck ready, cab up. | Flues reset. | Links. | | | | |
| | Wheels under, spring rigging up. | Boiler tested. | Pistons and rods. | | | Pilot repaired. | |
| | Boiler lagged, boiler jacketed. | | Main rods. | | Smokebox work. | Front running boards up. | |
| | Piping up, valves set. | | Side rods. | | Ash pan up. | | Tender painted. |
| | | | | | | | |
| | Completed and painted. | | | | | | Engine completed. |

THE 21-DAY SCHEDULE.

SCHEDULE FOR ENGINE NO. —— LIGHT REPAIRS.

| Date. | Erecting Shop. | Boiler Shop. | Machine Shop. | Smith Shop. | Tank Shop. | Carpenter Shop. | Paint Shop. |
|---|---|---|---|---|---|---|---|
| | Engine taken in and stripped. | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | Valve yokes, rods and straps. | Trucks completed. | | |
| | Cylinders bored. | | Valves and yokes. | Frames, brake work. | Frame completed. | Tender work. | |
| | Steam chests and valves up. | | Eccentric and straps, brake rigging, driving boxes & wheels. | Spring rigging and springs. | Tank repaired. | Cab repaired, running boards up. | |
| | Wheels under, eccentrics and straps. | Firebox work. | Rods, pistons and rods. | | Smokebox work, tender completed | Pilot repaired. | |
| | Valves set, rods up, completed. | | | | Ash pan up. | | New work painted. |

THE 8-DAY SCHEDULE.

constitute less than 10 per cent. of the total number of engines repaired. The schedules were prepared by consultation of the foremen, and it has not been found necessary to revise them. One of the benefits derived is a natural pride in keeping to the schedule, especially because the operating department is told when to expect the engines. When the date of delivery of an engine is made definite, the whole department is informed, and each shop must necessarily do its work systematically and in the order of its importance.

It is stated that since this schedule went into use the output of these 21 pits has been increased from 30 to 40 locomotives per month. Some of the improvement is due to improved shop equipment, but unquestionably most of it is due to the effect of the schedule in systematizing the work in the shops.

(Established 1832.)

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EDITORIAL ANNOUNCEMENTS.

**Advertisements.**—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING PAGES. *The reading pages will contain only such matter as we consider of interest to our readers.*

**Contributions.**—*Articles relating to railway rolling stock construction and management and kindred topics, by those who are practically acquainted with these subjects, are specially desired. Also early notices of official changes, and additions of new equipment for the road or the shop, by purchase or construction.*

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## CONTENTS.



This journal is pleased to announce that it has secured the services of Mr. Willard C. Tyler, who assumes charge of its Eastern Business Department on the first of this month. During the last four or five years Mr. Tyler has made several trips to Japan, China, and the Far East in the interests of certain locomotive and railway material manufacturers, with the result of a considerable increase in the use of the American locomotive in that part of the world. Mr. Tyler is well and favorably known to the railway supply and machinery trades through his long connection with the Railway and Engineering Review, and also Engineering of London.

## BETTER INSTRUCTION OF APPRENTICES.

From time to time for many years apprentice systems have been started under auspices which appeared to be favorable, and for one reason or another they have been dropped, sometimes gradually and sometimes suddenly. Just now a revival of interest in the subject appears in several directions, due undoubtedly to an awakening to the fact of a dearth of the right sort of material for filling subordinate positions, such as those of foremen. The cause of the lack of this material is in itself an interesting subject of speculation and an important one. It is sufficient for a discussion of its own.

The treatment of apprentices is revived periodically, plans and apprentice courses are lined out, each time upon "firm" bases, almost as regularly as "New Year's resolutions." Better instruction of apprentices is now spoken of, however in a way which warrants the conclusion that an earnest effort will soon be made to put this matter in better shape than it has ever taken. The whole apprentice question will be taken up again and more earnestly because it is necessary that it should be done.

If a motive power officer desires to raise the right sort of boys through his apprentice courses, how shall he go about it? He naturally wishes to induce study and encourage improvement among the boys with a view of leading them to improve themselves. It is difficult to accomplish this. Shall he establish a shop school, maintained by the company, and invite attendance from all apprentices, or shall such attendance be a requirement of apprenticeship? Granting that education is necessary, who shall be responsible for the schools and how shall they be organized and maintained? These questions are now being asked.

At the outset it is safe to say that improvements based upon the prevailing treatment of apprentices will fail in the future as they have in the past for very simple reasons. Busy officers find it easy to forget apprentices and their obligations to them. They are promised a training, systematic and thorough. Do they get it? Never—unless it is someone's business to see that the terms of the contract are fulfilled, and usually no one is held responsible for this. A boy in opening his apprenticeship is at the most impressionable stage of his life. If he is kept for a year at the bolt cutter—and this is by no means a rare occurrence—he should not be blamed for lack of enthusiasm. Such treatment naturally kills ambition so that a miracle will not resurrect it. The boy is defrauded and numbed. After this treatment can he be expected to jump at the chance to improve himself at hard study? Is it cause for wonder that it is so difficult to find responsive apprentice boys?

It is time to take up the school question when the boys are ready for it. After being defrauded as they are, almost universally, only those who are bound to rise regardless of difficulties will be ready for it. But fix the apprenticeship and the school will present an easy problem because the boys will want it. Fulfill the apprentice obligation and the best sort of a school is already practically established—but after that something more is needed.

Apprenticeship must necessarily be a farce unless the foremen understand and appreciate it and co-operate earnestly. No man is fit for foremanship who does not do this when encouraged to do so. Foremen must be interested in the

**boys. It would be well to include in the apprentice course a certain number of talks every year by the foremen upon subjects connected with the shop work, and perhaps an annual talk from the head of the department to all the boys. An occasional stereopticon talk on carefully selected subjects would awaken dormant interest. The officer preparing such a talk to good live boys will himself receive not the least benefit from the operation.**

**After going thus far a school will be demanded, or the writer is mistaken in his conceptions of human nature. Then comes the question of how to provide the school. In these days of the Y. M. C. A. the means are usually at hand. A bit of encouragement from the local officers of the railroad will probably meet a ready response from the local secretary of the association, or perhaps the local public school provides night instruction. If not, the railroad should provide for the deficiency, and for instructors the drafting room force is always available, and the work should be well paid for. The officers should not fail to see that the instruction for the shop boys meets their special needs. For example, arithmetic should be presented in such a way as to include the problems found in the shop and in the laying out of work.**

**With a good apprentice system faithfully fulfilled and the school establishment within or outside of the railroad, it will be easy to select the earnest boys. A very proper and profitable step after this would be to offer as a prize for earnest effort a few special two years' courses at the best technical school, with all expenses paid by the company.**

**Has anyone thought of establishing a "question box" for apprentice boys—or for men in the shop—to be discussed and answered by the foremen? This whole subject is a fascinating one and is full of interesting possibilities, and it will pay to think of it seriously. Some definite and practical commonsense plan that will interest and encourage self-improvement will in a short time surely develop enough material and to spare for recruiting all the offices of the department.**

**This journal wishes to enter a vigorous protest against further neglect of regular apprenticeship. Many of the ablest motive power officers of the present time have risen from this starting point. The door has been allowed to almost close. It must be opened again.**

Operating officers are becoming alarmed by the increasing frequency of break-in-twos, because of failures of couplers through wear and breakage. On several large railroad systems it has been decided to be necessary to stretch all trains on arrival at division terminals in order to inspect the couplers properly by gauges indicating the amount of wear of the coupler and knuckles. This requires considerable delay, but these officers are glad to provide time for the purpose of reducing the number of break-in-two accidents. The matter is becoming so serious as to warrant general adoption of this method of inspection.

## COMMUNICATIONS.

### THE RECORD-BREAKING TIRE-BORING OPERATION.

*To the Editor:*

Having read Mr. Pattison's letter on the tire-boring operation in the January issue of your paper, page 21, I take the liberty of differing with him as to the relative costs of boring tires at West Albany and at Roanoke. He has charged up the time of four helpers at West Albany and for but one at Roanoke. I think he has forgotten to charge the time of the two men which he states are required to roll tires for him, which should be accounted for.

He also says this work is done on a boring-mill which has been in use for 20 years. We did the work at West Albany on a mill, which has been in use for an equal length of time, before getting the new mill a year ago, which we now use. Since sending you the article, published in your November issue, we have done very much better, but do not think it necessary to publish it.

All that I wish to do is to prove to Mr. Pattison that he does not bore tires cheaper than is done at the N. Y. C. & H. R. shops at West Albany. Taking the same figures which Mr. Pattison has used, we have the following results; proving that Mr. Pattison has made a slight mistake and showing conclusively that we bore tires at a considerably less cost than is done at Roanoke.

Charging him with three helpers, as should be done, we have the following:

Roanoke Shops.—Norfolk & Western Railway.

| | |
|---|---|
| Time of One Mechanic, 4 2-3 hrs. at 50 cts. per hr....... | $2.33 |
| Time of Three Helpers, 4 2-3 hrs. at 12½ cts. per hour | 1.74 |
| Total cost for boring 10 tires........................ | $4.07 |
| Average cost for boring 1 tire...................... | .41 |

West Albany Shops.—New York Central.

| | |
|---|---|
| Time of One Mechanic, 4 2-3 hrs at 50 cts. per hr...... | $2.33 |
| Time of Four Helpers, 4 2-3 hrs. at 12½ cts. per hr...... | 2.32 |
| Total cost of boring 14 tires........................ | $4.65 |
| Average cost of boring 1 tire...................... | .33 |

This shows that, with more help than Mr. Pattison used, we bore tires 8 cents cheaper than he does.

ALBERT H. REESE.
19 N. Lexington Ave., Albany, N. Y.

### MAXIMUM PRESSURE ON CROSS-HEAD PINS OF COMPOUND LOCOMOTIVES.

*To the Editor:*

The interesting article entitled "Limits of Wear of Crosshead Pins," which appears on page 462 of the December, 1903, issue of the AMERICAN ENGINEER, contains the unqualified statement that for compound locomotives, the maximum normal load on the main crank-pins is obtained "by multiplying the low-pressure piston area by the boiler pressure and dividing this product by the cylinder ratio plus 1." Since this rule is totally unsuitable for determining the limits of pin wear of both Vauclain and tandem compound engines, and would probably result in very serious consequences if employed for this purpose, I beg to present the following explanation of the derivation of this rule, together with the modification necessary to render it applicable to the above mentioned types of locomotives.

The foregoing rule is based on the assumption that the engine is correctly designed, so that a practically equal division of total work is obtained between the high and low-pressure cylinders. Thus, if we consider a two-cylinder compound locomotive having a cylinder ratio of, say 1 to 3 (r=3), it is evident that it will require three times as great an effective initial pressure in the high-pressure as in the low-pressure cylinder in order to equalize the work between them. With a boiler pressure, P=220 lbs. per sq. in., we would, neglecting low-pressure, back-pressure and other losses, require 55 lbs. per sq. in. initial pressure in the low-pressure cylinder, and 220 lbs. per sq. in. initial pressure in the high-pressure cylinder, because this latter pressure is opposed by the 55 lbs. back-pressure offered by the receiver pressure (which is also the low-pressure initial pressure), thus leaving 220-55=165 lbs. per sq. in. *effective* initial pressure in the high-pressure cylinder, or three times the low-pressure initial-pressure. Consequently, the proper theoretical maximum low-pressure, initial-pressure is

$$\frac{220}{4} = \frac{220}{3+1} \text{ or } \frac{P}{r+1};$$

and letting A = the area in sq. ins. of the low-pressure piston, it follows that for any correctly designed two-cylinder compound locomotive, the maximum normal load (neglecting friction) on the cross-head pins, and on the main crank-pins $= \frac{P\,A}{r+1}$.

In the case of Vauclain and tandem compound engines, since both the high and low-pressure pistons act upon the same cross-head, the total effective initial pressure on the high-pressure pistons must be added to that on the low-pressure piston in order to obtain the maximum thrust on the cross-head pin. If we assume, as before, an equality in the work performed by each cylinder, it is obviously necessary to multiply the preceding expression by 2; and therefore, for Vauclain and tandem compound locomotives, the maximum normal pressure on the cross-head pins and main crank-pins $= \frac{2\,P\,A}{r+1}$

It is evident that neither of these formulæ take account of the enormous loads to which the main and cross-head pins are occasionally subjected, due to the presence of considerable quantities of water in the cylinders, since these augmented pressures result from abnormal conditions, and are consequently impossible to estimate.

EDWARD L. COSTER,
Assoc. Am. Soc. M. E.

25 Broad Street, New York, December 9, 1903.

## AN EXTENSIVE WATER-SOFTENING INSTALLATION.

TOTAL CAPACITY, 348,000 GALLONS PER HOUR.

PITTSBURG & LAKE ERIE RAILROAD.

IV.

(*Continued from page* 19.)

In the preceding article of this series a general description of the large and interesting Kennicott water softener, which is in use at the McKees Rocks locomotive water-supply station, was presented. The details of the automatic regulating apparatus for controlling the supplies of chemicals to the water to be treated were referred to only in a cursory manner on account of lack of room; the importance of these factors of the system are so great that they will be referred to in this article in considerable detail.

In the first place, attention should be called to the method of graduating the supplies of water to the chemical tanks, including soft water for the lime saturator and soda solution for the mixing chamber. As stated in the previous article, the amount of raw water flowing into the softener governs the rate of flow of the chemical solutions for chemical action; the method of accomplishing this is by an interesting system of a float and head-varying devices in each of the solution tanks. The float, Y, is located in the raw water tank, B, and chains passing over pulleys from this float regulate the positions of these head-varying devices in tanks, T and N.

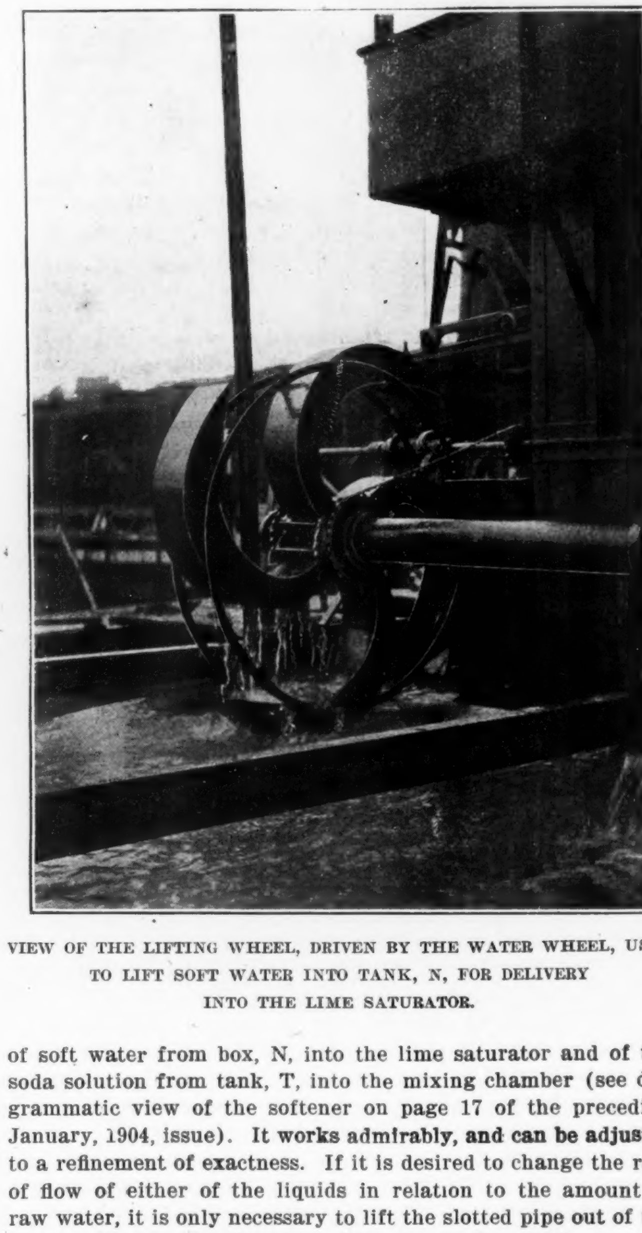
This arrangement is very nicely shown diagrammatically in the first view below. The float is shown within a guiding cylinder in the raw water tank, above the water wheel, and the

DIAGRAMMATIC VIEW OF THE FLOAT MECHANISM FOR VARYING THE HEIGHT OF THE ORIFICE IN THE TANK OUTLET PIPE, AS USED TO CONTROL THE RATE OF FLOW OF THE CHEMICAL SOLUTIONS.

chain runs from it, over two pulleys, and down to a swinging pipe in the tank below. The principle upon which the slotted orifice is made to work is as follows: This orifice is smaller in cross-sectional area than the pipe into which it admits the water, and, therefore, the flow through it is dependent upon the hydraulic head acting upon it, which, in turn, depends upon its distance below the surface of the water. Thus, when it is desired to have the flow through the pipe the greatest, it is only necessary to drop this orifice to its lowest position, and for the least flow, to raise the orifice as high as possible.

It is evident that the flow of the chemical solution from the tank through the orifice should be in proportion to the amount of raw water entering the softener. Inasmuch as the raw water enters the machine through the slot in the lower side of tank B, which directs it upon the water wheel, C, the amount of flow of this raw water depends upon the hydraulic head in the tank, B, or the height of the water in that tank; as the water rises in tank, B, the flow into the softener increases, and vice versa. In this way may be seen the principle which is made use of in the float operating the slotted pipe: As the head in tank, B, increases, the flow of the solution from the lower tank is also increased by the rising of the float and the resultant dropping of the slotted pipe and increase of flow through it.

This principle is made use of both for controlling the supply



VIEW OF THE LIFTING WHEEL, DRIVEN BY THE WATER WHEEL, USED TO LIFT SOFT WATER INTO TANK, N, FOR DELIVERY INTO THE LIME SATURATOR.

of soft water from box, N, into the lime saturator and of the soda solution from tank, T, into the mixing chamber (see diagrammatic view of the softener on page 17 of the preceding January, 1904, issue). It works admirably, and can be adjusted to a refinement of exactness. If it is desired to change the rate of flow of either of the liquids in relation to the amount of raw water, it is only necessary to lift the slotted pipe out of the water and move the threaded sleeve forward or back, so as to cover or uncover the slot; in this way the effectual size of the orifice may be adjusted at will.

In this connection it may be of interest to state why it is that soft water is used for making the lime solution in the lime-saturator. This is done to prevent the precipitation of the scale-forming impurities in the lime-saturator tank in the quantities which would occur if raw water were used for this purpose. The proportion of impurities brought down by the lime solution is much the greater of the two solutions, and this, taken in connection with the large amount of lime solution used, makes it advisable to use soft water for this purpose, whereas in the case of the soda solution, so little of the same is used in comparison to the total amount of solution treated

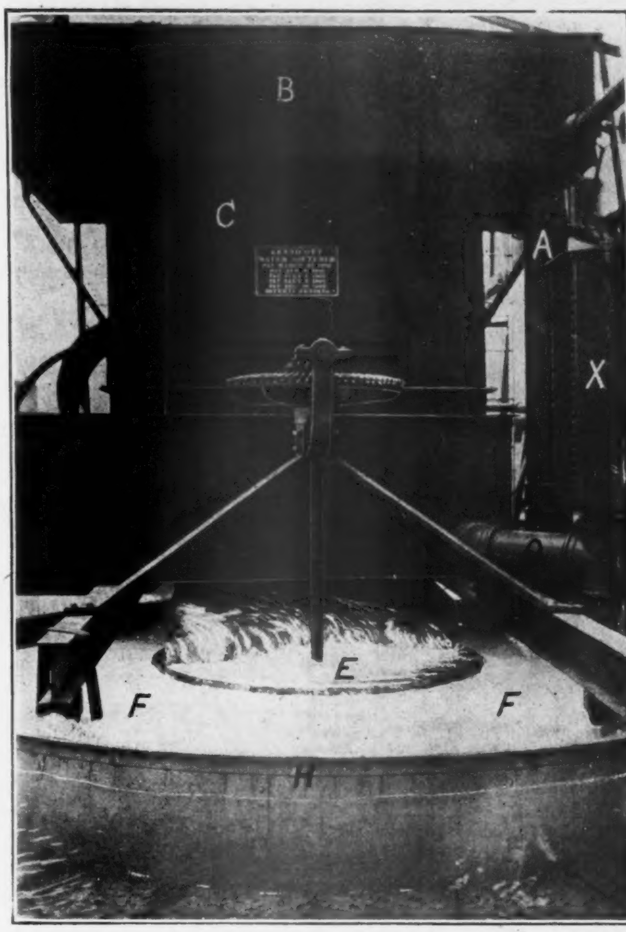
that the effect caused by any precipitation from the raw water in the soda tanks is not troublesome.

The method of lifting the soft water up into the tank, N, is interesting. It is accomplished by means of the wheel, L, having hollow curved arms, open at the ends, which dip into the water and lift it up; the water flows through its arms into the large hollow shaft, M, and thence into tank, N. This wheel is revolved by means of a chain-drive connection from the shaft of water wheel, C. The passage of the entering raw water over water wheel, C, which is of the over-shot type, generates sufficient power to easily operate this lifting wheel for this and other service. An excellent idea of this wheel may be obtained from the accompanying view of the same, which is from an instantaneous photograph of the wheel when in operation; the closed portions of the curved arms are easily recognized and the dripping of water from the arms was realistically caught by the camera. The important feature of this method of raising the soft water into the supply tank, N, is that it eliminates the necessity of providing a mechanically operated pump at the top of the softener; the water is thus lifted entirely by the action of the raw water passing over water wheel, C, in entering the softener. This feature of the mechanism requires practically no attention.

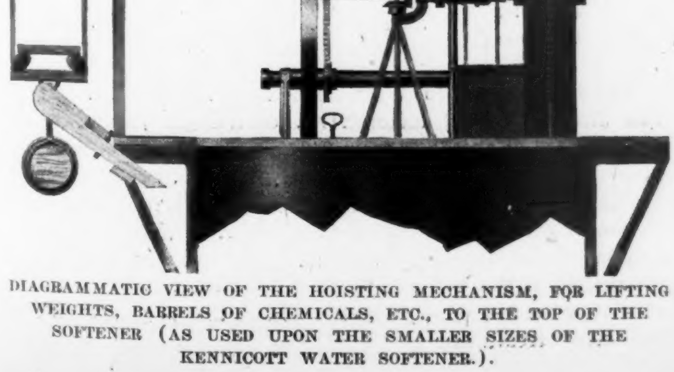
The soda solution is prepared in the two tanks, R-R, each of which contains a wire basket at one side for holding the soda. This greatly facilitates the dissolving of the soda into the water, as it drops down from the basket into the water gradually as it dissolves away. These tanks are constructed of sheet steel, square in shape, and are elevated upon a structural stand, bringing their bases 30 ins. above the top of the softener. They are each 3½ ft. high and of sufficient size each to supply soda solution to the softener for a 12 hour run.

They are supplied with water directly from tank, B, as before stated. These tanks are used alternately, the solution in one being prepared while that in the other is being used. They are filled through the pipe, Z, and deliver through pipe, S, to the soda solution tank, T. A constant level is maintained in tank, T, by means of ball cocks and floats, as indicated in the plan drawing of the top of the softener, page 64. From tank, T, the soda solution is delivered into trough, D, to enter the mixing chamber, E, by means of the slotted pipe arrangement of orifice, as above described.

On account of the great size and capacity of the McKees Rocks softener, relatively large proportions of soda are required, which must be dissolved as quickly and with as little labor as possible. In this connection an important and unique feature has been introduced to accomplish the rapid solution of the soda ash in the tanks. A small air compressor was installed to be driven from the shaft of water wheel, C, which drives the lifting wheel, and its discharge was piped to a perforated delivery pipe, extending around the sides of the soda tanks at the bottom. The passage of the numerous streams of air through the solution thoroughly agitates the water in these tanks and entirely eliminates the possibility of caking of the soda. The effect of this agitation process is to cause the water to circulate in the tanks violently and has been found to greatly facilitate the solution of the soda ash.




VIEW OF THE TOP OF THE McKEES ROCKS SOFTENER WHILE IN OPERATION. RAW WATER ENTERING MIXING CHAMBER AT E; CLEAR SOFT WATER ABOVE FILTER PLATES IN IMMEDIATE FOREGROUND.



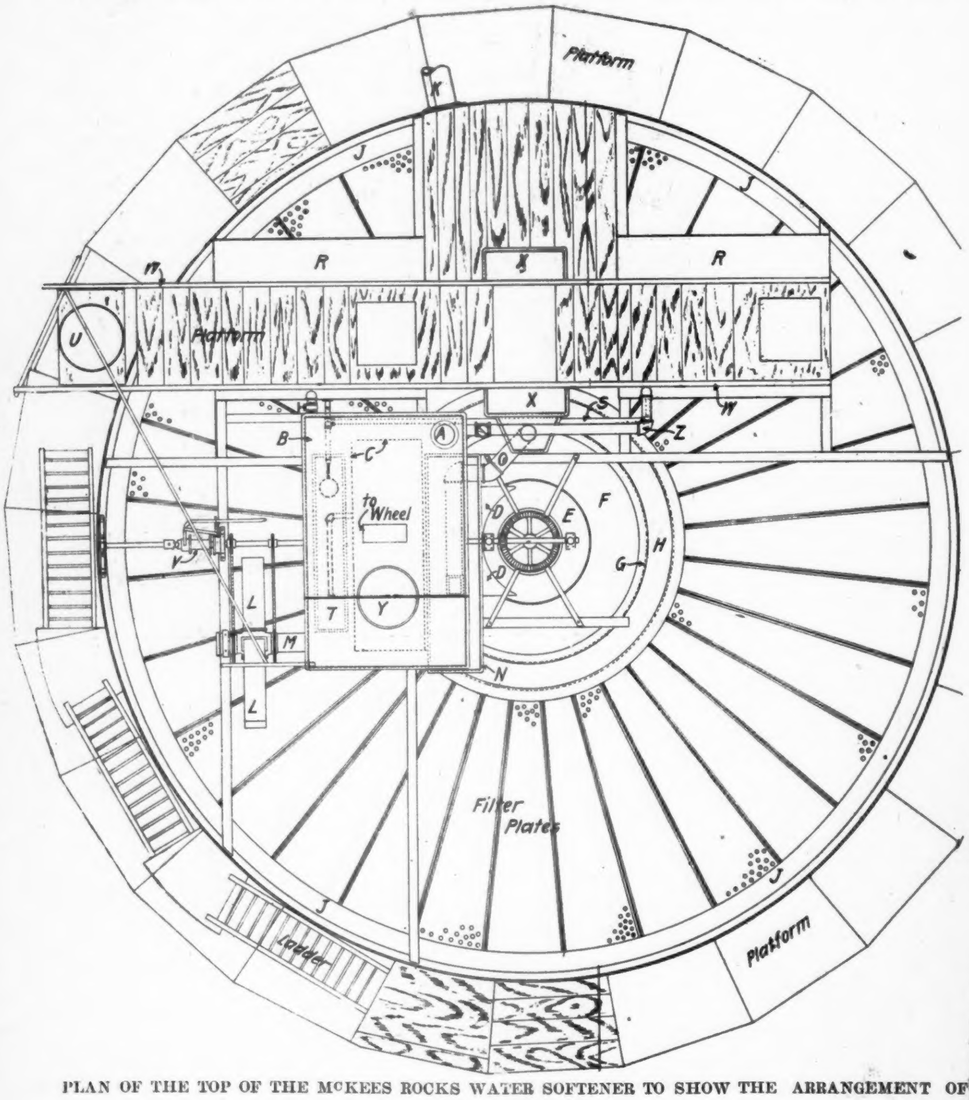
DIAGRAMMATIC VIEW OF THE HOISTING MECHANISM, FOR LIFTING WEIGHTS, BARRELS OF CHEMICALS, ETC., TO THE TOP OF THE SOFTENER (AS USED UPON THE SMALLER SIZES OF THE KENNICOTT WATER SOFTENER.).

On this page is presented another very interesting view upon the top of the McKees Rocks softener. This view is taken from a point on the platform opposite the stairway side of the softener and looking directly at soft water tank, N, and into trough, D. In the upper part of the view is shown raw water tank, B, which rests upon the top of the case surrounding water wheel, C. Beneath tank, N, the raw water appears entering the mixing chamber, E, from trough, D. Also entering mixing chamber, E, may be seen the vertical shaft, which is driven through bevel gearing from the water wheel shaft; this is the shaft which drives the mechanical agitators at the bottom of the lime-saturator. In front of the mixing chamber, E, may be seen the water rising, milk-white, from the revolving deflector plate chamber, F, and flowing over the edge of tank, G, into the space within the settling cone, H; this is very clearly shown. In the extreme foreground the soft water is clearly shown between cone, H, and the edge of the softener, where it has just risen up through the filter. This view presents an excellent idea of the operation of the softener.

The hoisting device which forms a part of the mechanism of the Kennicott softener is an interesting and economical feature of its operation. The accompanying view of one of these hoists explains clearly its mode of operation. The hoisting drum, V, consists of a loose sliding sleeve upon the water wheel shaft, which may be slid over into clutch with a collar revolving with the shaft, or released, by means of the handle shown in the plan drawing. When thrown into clutch it takes

power from the water wheel shaft and winds up the rope over the pulleys and lifts the barrel of chemicals, or the can, U, as desired. On the McKees Rocks softener there is an elevated track, W, extending across the softener and running under the hoist; as the barrel is lifted to the top of the hoist, the little car is run under the same, after which it may be run across to either side of the tank. For lowering a weight to the ground there is provided a friction brake at the end of the drum, V, opposite from the clutch; by moving the drum over against this brake shoulder, weights can be dropped to the ground as slowly as desired.

The view of the hoist mechanism on page 63 shows the tilting platform method of receiving the weight after it has reached the top of the tank. After it has been lifted above this swinging platform, the platform drops back into place and acts as a floor to receive the weight. This is the construc-




PLAN OF THE TOP OF THE McKEES ROCKS WATER SOFTENER TO SHOW THE ARRANGEMENT OF THE APPARATUS.

tion used on the smaller sizes of softeners; upon the larger sizes of softeners, of capacities of 40,000 gals. per hour and over, the elevated track and larry-car method of receiving the weight is used, as shown upon the top of the McKees Rocks softener. Another important feature of this lift is the spacer for separating the ropes used for hoisting; by thus separating these two ropes the inconvenient swinging of the weight is eliminated and no time is lost in this way.

At the right, on this page, there is an interesting view, which presents a sectional diagramatic view of one of the Kennicott softeners to illustrate the method of operation. The construction shown in this view is that used in the smaller softeners of the installation on the Pittsburg & Lake Erie, although it does not differ in principle from the large softener at McKees Rocks. The arrangement of the baffle plates outside of the settling cone and of the lime-saturator tank within, as well as the other important characteristic details of the Kennicott water softener are comprehensively shown in this view.

Some of the features of the operation of the large softener at McKees Rocks may be of interest: This softener is run to its full capacity for 12 hours per day. The only attention required is at starting up time and at noon, at each of which times 3½ bbls. of lime and 750 lbs. of soda are added to the lime-saturator and to the soda tanks respectively. The main sludge valve at the bottom of the settling cone is opened twice a day also, at each of which times nearly half a ton of scale-forming material—which, otherwise, would go into the locomotive boilers—is discharged into the sewer. When this softener is operated 10 hours per day with the present mode of treatment, 1,974 lbs. of solid matter are precipitated.

SECTIONAL VIEW OF A TYPICAL KENNICOTT WATER SOFTENER, SHOWING CLEARLY ITS INTERNAL CONSTRUCTION.

Water is supplied to this softener from a well 45 ft. deep by two direct-connected motor-driven centrifugal pumps, which are operated at speeds of from 840 to 1,200 rev. per min. Each pump has a capacity of 1,000 gals. per min., one pump only being worked at one time. They lift the water about 85 ft. at a cost of about $0.006 (6-10 cent) per 1,000 gals.—for power and labor. At the present time the amount of scale-forming impurities in the water is reduced from the raw water condition of about 24 grains per gallon to less than 5 grains per gallon after treatment.

## COAL CHUTES FOR LOCOMOTIVES.

### A NEW IDEA IN MEASURING COAL.

#### BALTIMORE & OHIO RAILROAD.

Railroad officers having charge of coaling stations for locomotives have in many cases of late, indicated their unfavorable opinion of weighing devices by omitting them entirely and going back to the old method of dumping coal on tenders with no attempt at obtaining an even approximate record of the amount delivered to each engine. They have been building chutes which have no provision for measuring coal given to each engine.

In such cases the coal record standing of the engine crews must necessarily be given up and efforts to save coal must be confined to those which are put forth by the traveling engineers and firemen. This appears to be a serious mistake which can not be considered as an advance step, or as one leading to the best use of fuel. This journal holds the opinion that coal must be weighed or accurately measured in order to form the basis for its economical use.

The Baltimore & Ohio chutes at Brunswick, Md., at Keyser and Fairmont, W. Va., and at Newcastle Junction, Pa., are interesting in this connection. They provide delivery pockets in pairs, each pair containing 4 and 2 tons of coal, which are made to measure the coal as accurately as it can be measured by volume. These pockets project over the track as indicated in the accompanying engravings, which show clearly the details of construction.

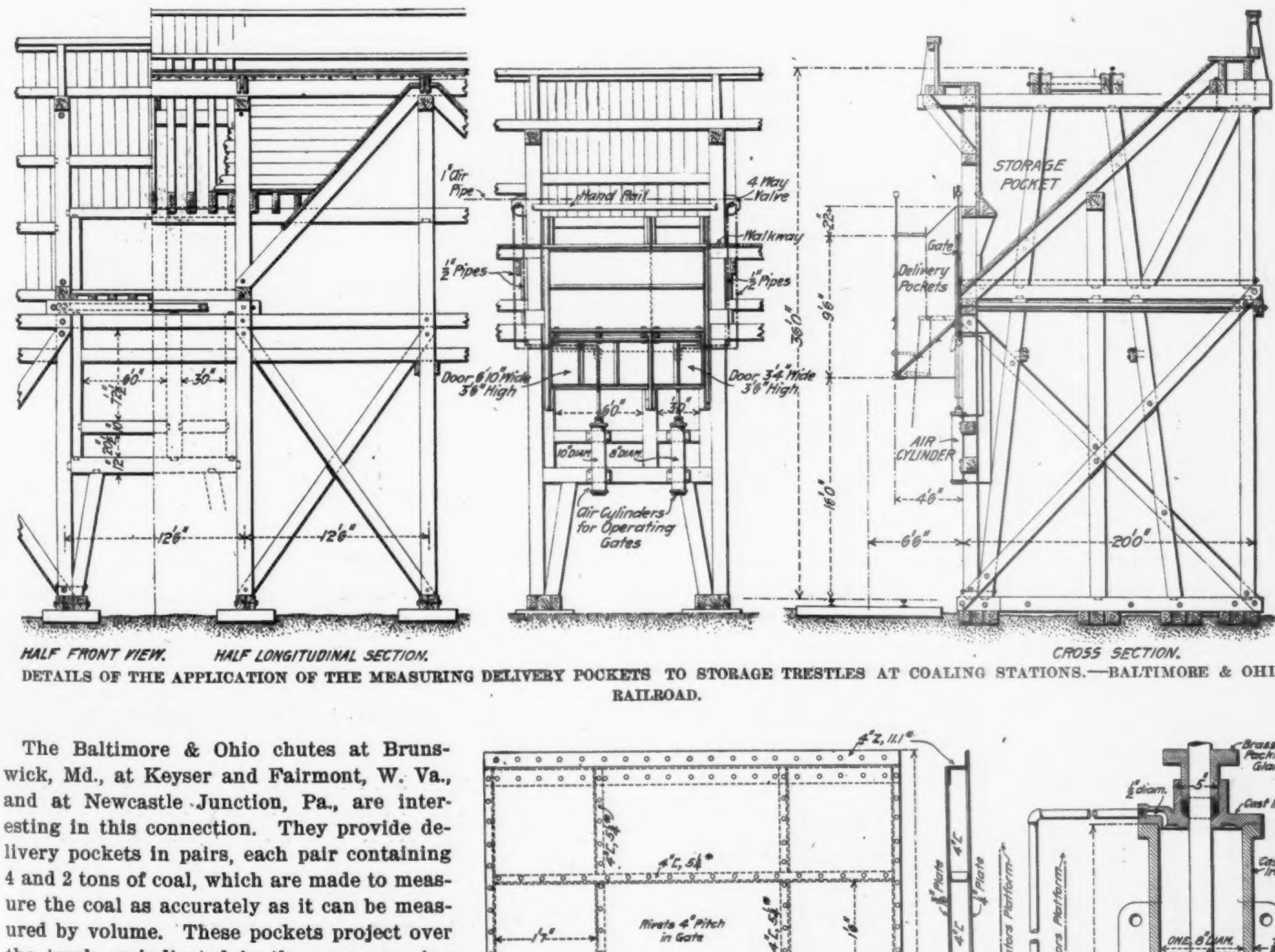
Two sizes are provided, in order to adjust the amount delivered without gauging or partially emptying a pocket. When 4 tons are wanted the large pocket is emptied. Both pockets used together give six tons, and for 8 tons the 4-ton pocket is used twice. The small pockets are filled from a 60-ton storage pocket overhead.

By using pneumatic, vertically moving gates between the storage and delivery pockets the latter may be emptied and filled in less than one minute. A method of interlocking the shutoff gates with the delivery valves, which is provided, makes it possible to deliver coal to a tender while the main shutoff gates are open. With this arrangement the average delay to locomotives at these chutes is reduced to 2¼ minutes. Coal comes to the chutes in 50-ton cars and is unloaded directly into the storage pockets, each of which takes the full load of a car. There is no manual handling of the coal, and the total cost of the operation of the chute with 10 pockets is the maintenance and the labor of two men.

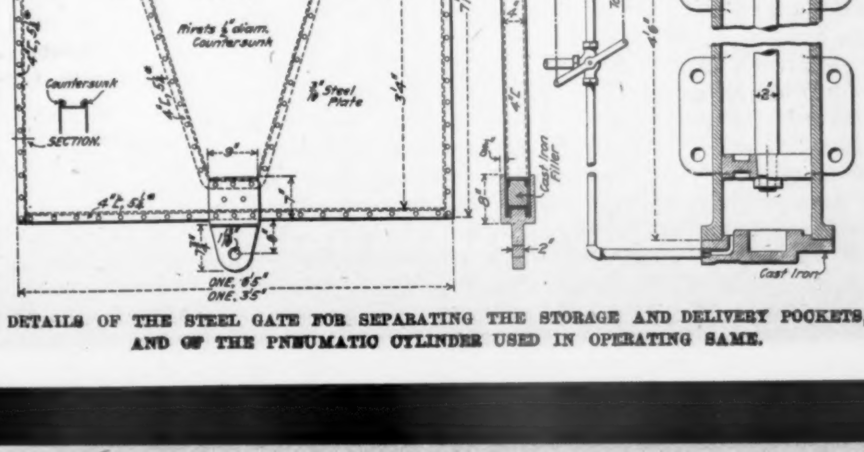
Thus far the two sizes of delivery pockets have met all requirements. The pneumatic cylinders for operating the gates appear to be entirely satisfactory and the idea of the construction promises to provide a way to retain individual coal records, combined with a very inexpensive method of handling coal. We are indebted to Mr. V. Z. Caracristi for the information and to Mr. J. E. Muhlfeld, general superintendent of motive power for the drawings. These are selected with a view of self explanation.

In regard to the operation of this system, Mr. Muhlfeld states:

"The storage and delivery trestles of this type that we have in use at the above points are giving very good results. We




DETAILS OF THE APPLICATION OF THE MEASURING DELIVERY POCKETS TO STORAGE TRESTLES AT COALING STATIONS.—BALTIMORE & OHIO RAILROAD.



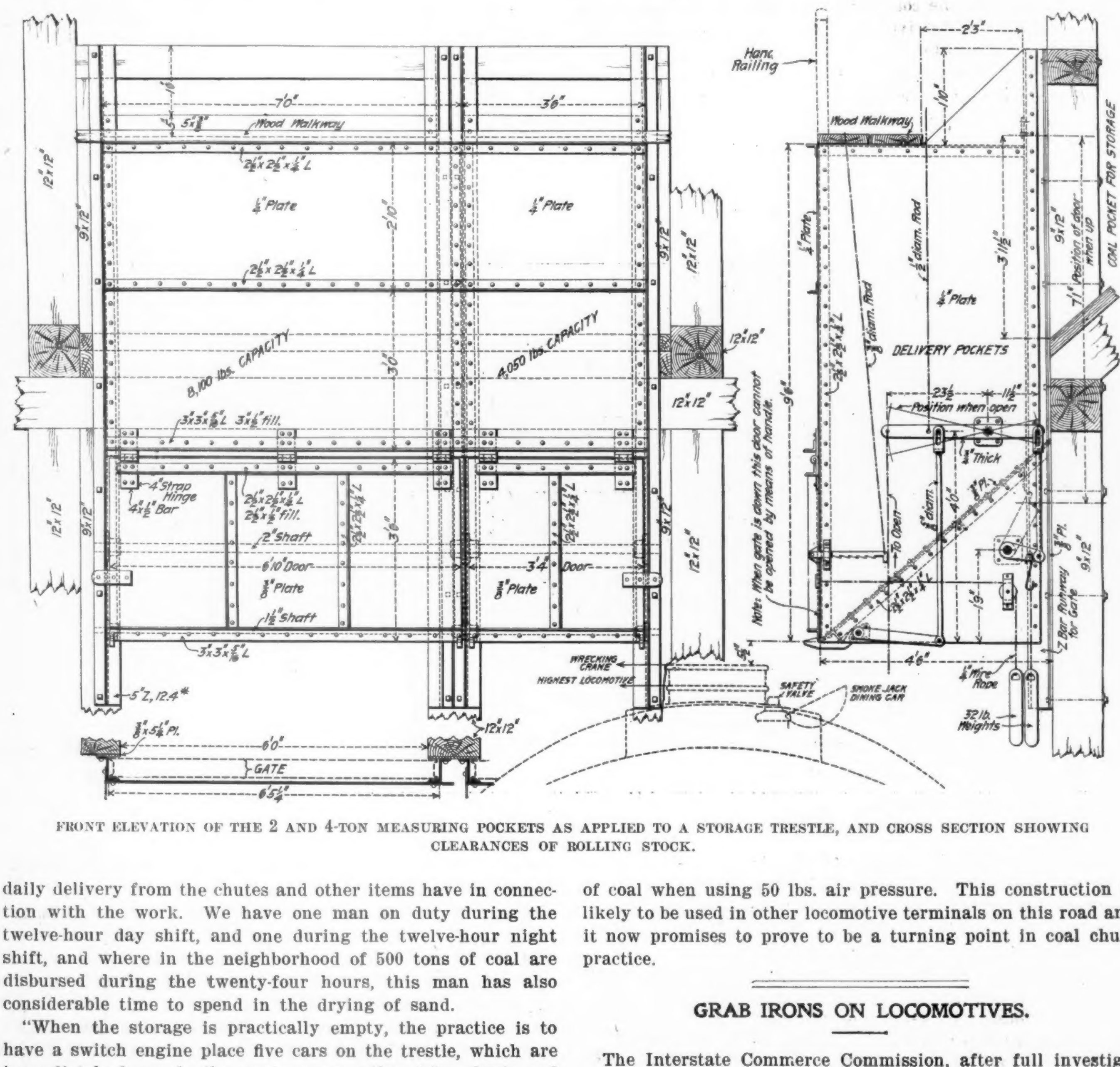

DETAILS OF THE STEEL GATE FOR SEPARATING THE STORAGE AND DELIVERY POCKETS, AND OF THE PNEUMATIC CYLINDER USED IN OPERATING SAME.

find that at the present time, the two-ton unit of coal to be delivered to locomotive tenders is about as small as necessary; in fact, our records show that there is less than one-fifth of the coal that is delivered from the two-ton pockets, the four-ton being used to the greatest extent. The coal supplied to tenders is always in two or four-ton lots, or in multiples thereof.

"With the fifty-ton storage pockets filled with coal, to each one of which is attached a two and a four-ton measuring pocket, it is possible to dump the coal from both of these pockets, refill them and again dump, supplying in all twelve tons to the tender, in less than one minute. We handle the coal from steel-hopper self-dumping cars to the locomotive tenders from these coaling trestles at a cost ranging between ½ cent and 1 cent per ton, depending on the effect that weather conditions, operates the gate, controlling the flow from the large storage, from the measuring pocket platform; the coal can then be dumped from the measuring pockets to the tenders either from the measuring pocket platform, or from the engine cab. The amount of coal received and disbursed on each coaling trestle is balanced each day, and what slight adjustments may be necessary, can be promptly taken care of.

"There is very little difficulty or expense experienced on account of spilled coal from the tenders having to be picked up from the ground, and we think that the labor expense in connection with handling the coal around the trestle is reduced to the minimum."

It should be stated that the air cylinders were made of such diameters as to insure closing the gates through the streams




FRONT ELEVATION OF THE 2 AND 4-TON MEASURING POCKETS AS APPLIED TO A STORAGE TRESTLE, AND CROSS SECTION SHOWING CLEARANCES OF ROLLING STOCK.

daily delivery from the chutes and other items have in connection with the work. We have one man on duty during the twelve-hour day shift, and one during the twelve-hour night shift, and where in the neighborhood of 500 tons of coal are disbursed during the twenty-four hours, this man has also considerable time to spend in the drying of sand.

"When the storage is practically empty, the practice is to have a switch engine place five cars on the trestle, which are immediately dumped; the empty cars are then taken down, and five additional cars run up and dumped; these latter empty cars are then taken down and another lot of five cars placed on the trestle, and the hopper doors opened. This makes a storage of 750 tons, 500 tons of which will be in the storage pockets in the trestle, and 250 tons in the cars. In addition to this, 60 tons can be stored in the measuring pockets at the same time, making a total storage of 810 tons, which, at the average coaling station, will make it unnecessary to switch the trestle more than once during the twenty-four hour period.

"We find that the measuring out of the coal by this gravity method is close enough for all ordinary purposes. The coal is dumped into the self-measuring pockets by the tipple man who of coal when using 50 lbs. air pressure. This construction is likely to be used in other locomotive terminals on this road and it now promises to prove to be a turning point in coal chute practice.

## GRAB IRONS ON LOCOMOTIVES.

The Interstate Commerce Commission, after full investigation and consideration of the matter involved in the above title, rendered opinion and filed its report, ordering: That the time of common carriers by railroad in the United States to comply with so much of Section 1 of the Act of Congress of March 2, 1903, as requires the application of grab irons to the front ends of locomotives and sides of locomotives near the front ends, be further extended to the first day of March, 1904.

Mr. Charles A. Hino, who for many years has been connected with the mechanical department of the Lake Shore & Lackawanna in Buffalo, has been appointed general foreman in the Delaware, Lackawanna & Western shops at Elmira.

## MACHINE TOOL PROGRESS.

### FEEDS AND DRIVES.

### XIII.

BY C. W. OBERT.

For some time a need has been generally felt for a mechanical speed-changing device of small size and simple, which may be used in connection with variable-speed motor drives of limited speed-range (such as those using field control) and in other cases for driving machinery, where a few speed changes are necessary and desirable. The use of a device designed to fulfill these requirements would do much to afford simplicity for methods of motor driving and would make possible the use of individual drives in many places where it would be prohibitive otherwise.

In the accompanying engravings is illustrated a new and interesting form of positive-drive variable-speed mechanism, recently perfected and placed upon the market by the National Machine Tool Company, Cincinnati, O., which fullfils these requirements. This device was designed by Mr. W. L. Schellenbach, President of the company, and is similar in general principle to the lárger variable-speed countershaft, built by this company which was described in article VI. of this series (page 229, June, 1903). The new mechanism differs from the former, however, in that it provides a smaller number of steps, although the speed range is fully as large. The most noticeable feature of this new device is its compactness in relation to the capacity.

The principle of operation is essentially that of the Schellenback method of raising loose gears into mesh with the revolving gears of a gear-cone, and clutching them on the splined shaft in the manner that was described in Article VI. of this series. But the arrangement of parts and adaptation of the principle of this device, as well as its form of case, present many changes and improvements that will be of interest.

The main frame, or casing, is built oil tight, making it possible for the gears to be run in an oil bath. It is designed to be separated on a horizontal plane directly between the two shafts; the upper and lower half being doweled and held together by screws. The gear casing has planing pads running its entire length on four sides; these are drilled and tapped, to receive a form of hanger which can be attached to the top for bolting it to the ceiling; to the sides for bolting it to the wall, and to the bottom for mounting it directly upon the floor. The planing pads are also a great convenience in attaching the gear casing directly to the side of a machine tool.

In using the device as a regular countershaft, it is only necessary to have the gear casing and necessary hanger for attaching it. The usual cone-pulley countershaft may be cut off at the cone and attached to shaft "A" of the speed changer by a coupling thus avoiding the extra expense of the pulleys otherwise necessary. The operating handle may be extended up or down to within easy reach of the operator of the machine to be driven.

This device is well illustrated in the engravings, Figs. 56, 57 and 58. Fig. 56 is an interesting and comprehensive view; it illustrates the device with a part of the case cut away to show the interior. Fig. 57 is an end elevation of the exterior and Fig. 58 presents a longitudinal and a cross section of the

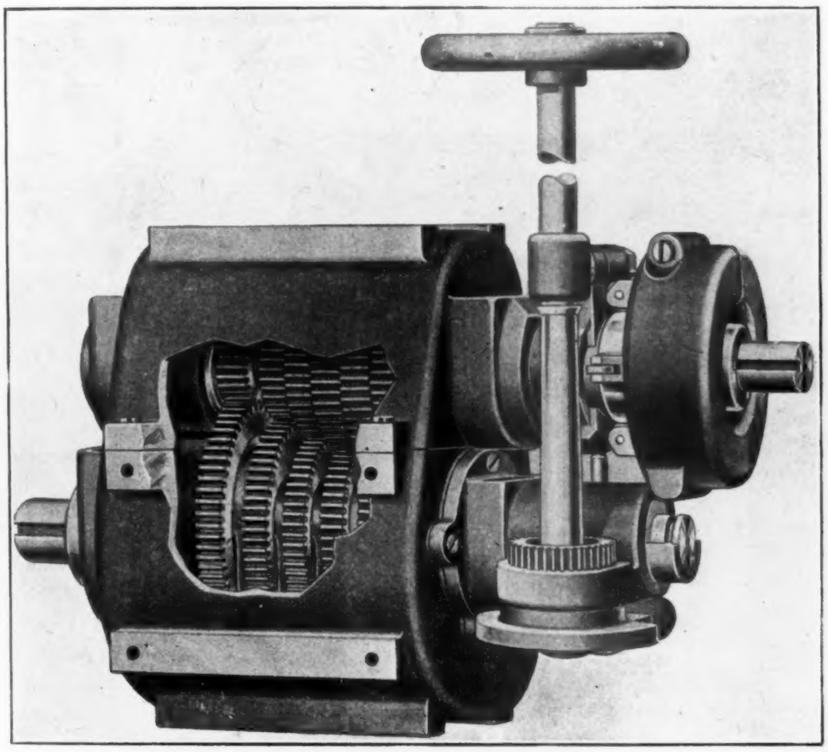


FIG. 56.—GENERAL VIEW OF THE NEW SPEED CHANGER, SHOWING PADS FOR ATTACHING TO HANGER OR MACHINE.

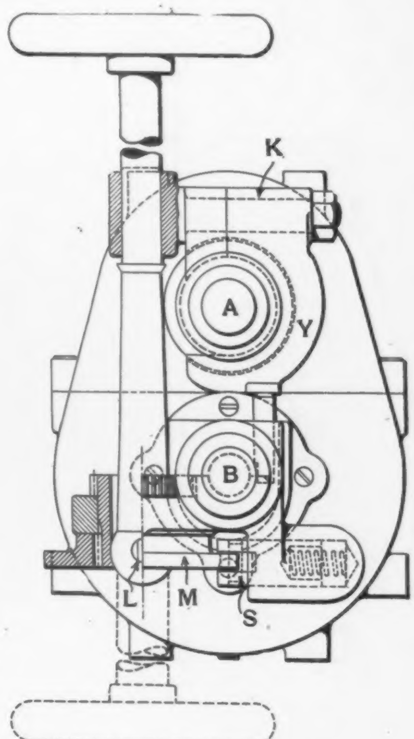



FIG. 57.—END ELEVATION SHOWING OPERATING HANDLE MECHANISM, AND PLUG ATTACHMENT, S.

device. As may be seen from these the upper shaft, A, is the driving shaft, while the lower shaft, B, delivers to the driven machine. Shaft A, carries the solid cone, C, of five gears, running loosly upon it, and at its left end has a small pinion, G, cut on it to mesh with large gear, H, on the lower shaft.

The important feature of this device is that it is so arranged that while a change of speed is being made the slowest speed of the series is always in action; that is, in changing from one speed to any other of the series the friction clutch, K, on the upper shaft is released and the speed will diminish until the slowest speed is reached, continuing at that speed until the desired speed is selected, which speed will become operative the instant the friction is re-engaged. The changing is performed as follows:

The lower shaft which is of tool steel, is made with an enlargement at about the center, which enlargement is beveled at both edges and is provided with tool-steel spring keys to clutch into the seats cut into the bores of the loose gears. The lateral motion of the enlargement, N, of the lower shaft imparts vertical motion to the gears meshing and unmeshing them from their mates above as it passes through their bores. This lateral motion is imparted to the lower shaft through a rack sleeve cut on it at the right-hand end, and a gear meshing therewith, which receives the ball seated lever, L. This lever carries a

hand wheel, which can be arranged either above or below the casings as is shown by the dotted lines.

The gears on the upper shaft, with the exception of the small pinion, G, turned on shaft "A" is controlled by the friction clutch, K, which is operated by lever, L, on shaft, A. The

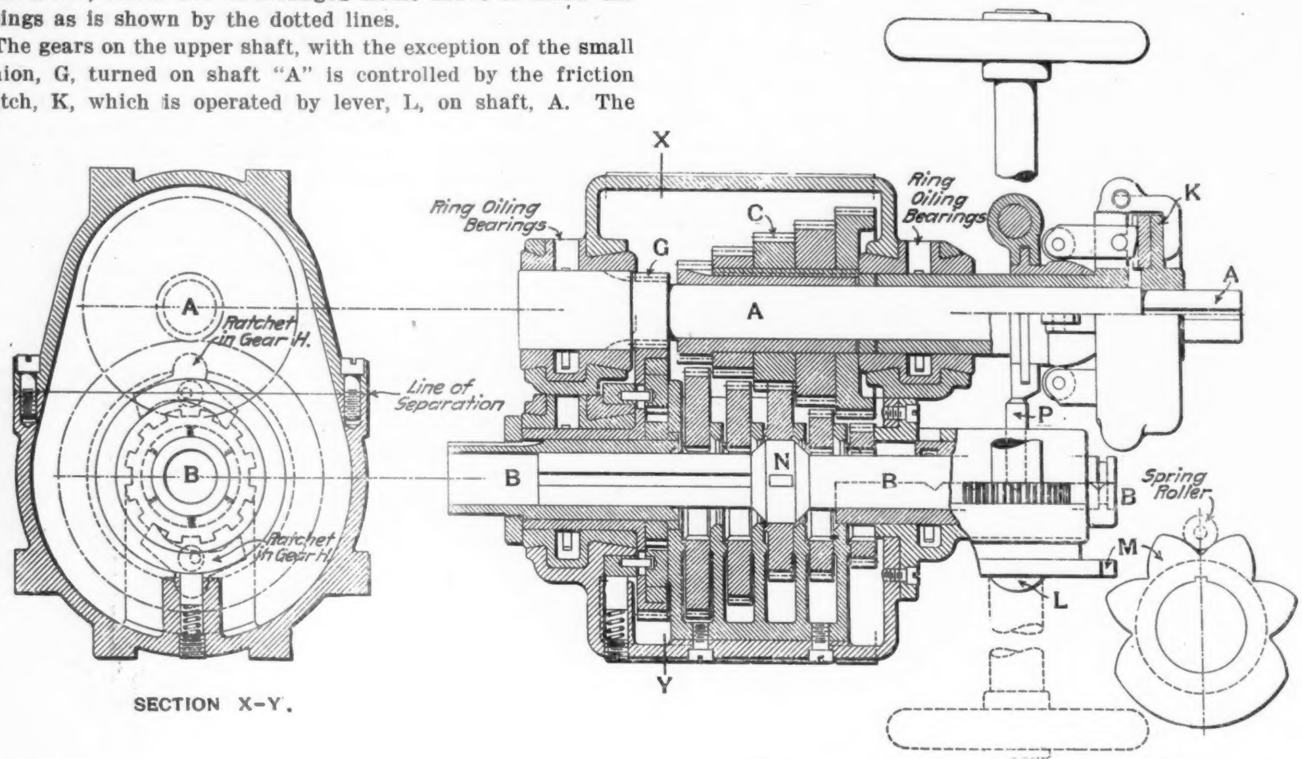



FIG. 58.—CROSS AND LONGITUDINAL SECTIONS OF THE NEW SCHELLENBACH SPEED-CHANGING MECHANISM, SHOWING MODE OF OPERATION, AND DETAIL OF CAM, M.

largest gear of the lower cone is always in mesh with gear, G, and transmits the slowest speed to the lower shaft by a ratchet device, the pawls of which are carried by it. The ratchet, which is really a part of the lower shaft, will always revolve faster than the pawls, when any speed higher than the slowest is used and will thus be running idly at those times, but the moment that friction clutch, K, is released by lever, L, however, the lower shaft will slow down until it reaches a speed equal to that of the pawls. The pawls are automatically reversible so that they will be effective when running in either direction.

When friction, K, is engaged the lower portion of the yoke Y, which operates the cone, rests directly on the top of plug, "P", the lower end of which is beveled to fit into the notches of the sliding rack sleeve which operates the lateral motion of the lower shaft. This makes an effective locking device, which compels the releasing of the friction and thus taking all load off the gears while a change of speed is being made; it also prevents the locking of the friction if the change is only partially completed. A spring seated plug secured to the rack gear and carrying a roller which engages cam M, determines the proper lateral adjustment of the lower shaft.

This device may be connected directly to an electric motor to give mechanical speed changes of ratios arranged in geometrical progression, of from 8 to 1 down to 2 to 1. The ratios and number speeds may be arranged to suit almost any condition, with this construction, and the hand wheel then indexed to correspond with the speeds.

This speed changer is built in six sizes to transmit from one-half to ten horsepower running at 375 revolutions per minute. An idea may be gained of its sizes for the different capacities by reference to the following dimensions:

DIMENSIONS OF THE VARIOUS SIZES OF SPEED CHANGERS.

| Horse-power, 375 R.P.M. | Pitch Gears. | Diam. Shafts A. and B. | Length of Bearings. | Length, Case. | Length, Total. | Width, Total. | Height, Total. | Distance between Shafts. |
|---|---|---|---|---|---|---|---|---|
| ½ | 14 | 13-16 | 1¾ | 4 11-16 | 12 | 5⅝ | 7¼ | 2½ |
| 1 | 12 | 1 | 2⅝ | 6¾ | 16 | 6⅝ | 8½ | 2 11-12 |
| 2 | 10 | 1 3-16 | 3 | 8½ | 21⅞ | 8 | 10½ | 3½ |
| 4 | 7 | 1 7-16 | 3⅝ | 10¼ | 25⅝ | 11 | 14¾ | 5 |
| 7 | 6 | 1 11-16 | 4¼ | 12 | 29½ | 13½ | 17½ | 5 5-6 |
| 10 | 5 | 1 15-16 | 5 | 13¾ | 35 | 16 | 21 | 7 |

As will be noted from the above table of sizes, the length over all on a changer of ½ horsepower is but 12 ins., while on the largest size made, 10 horsepower, the length is but 3 ins. All gears used are made of mild steel forgings.

The principal object of the National Machine Tool Company in bringing out this design of speed changer has been to make it adaptable to the many varied conditions of driving and to also produce a design which can be manufactured as an article of stock and sold in standard sizes suitable to meet the requirements of the trade. With a view to ascertaining the needs of machinery builders and users W. L. Schellenbach, president and general manager, recently made an extended tour of a large number of works in this country and this device is intended to fill a long felt need.

## PERSONALS.

Mr. P. P. Wright has resigned as assistant general manager of the Lake Shore & Michigan Southern.

Mr. A. H. Babcock has been appointed electrical superintendent of the Southern Pacific, with headquarters at San Francisco, Cal.

Mr. W. G. Wallace has been appointed superintendent of motive power and cars of the Duluth, Missabe & Northern, with headquarters at Proctor, Minn., to succeed Mr. William Smith, resigned.

Mr. W. K. High, master mechanic of the Cleveland, Cincinnati, Chicago & St. Louis at Mount Carmel, Ill., has been transferred to the Wabash shops of the company to succeed Mr. W. J. Thomas, resigned.

Mr. C. S. Hall has been appointed master mechanic of the Boston & Maine at Springfield, Mass., succeeding Mr. Aiken. Mr. Hall has been with the Boston & Maine for over thirty years, having filled various positions in the operating and motive power departments, including sixteen years as engineer.

The many friends of Mr. O. H. Reynolds, formerly connected with the American Locomotive Company, will be pleased to learn that he has joined the editorial staff of the *Railway and Engineering Review* of Chicago. He will be their editorial representative in the East, with headquarters at 140 Nassau street, New York City.

## MOTOR-DRIVEN MACHINE TOOLS.

### PLANER DRIVING BY ELECTRIC MOTORS.

The conditions under which the metal planing machine is operated are such that the problem of motor driving presents some features quite different from most other machine tools. Anyone who has opportunity to compare the planing machine of to-day with one built twenty years ago, will be struck with the fact that, while it has in some ways been considerably improved, in other ways the rate of advance has not kept pace with some other machine tools. The planing machine has been, and is yet considered, by some, a mechanical absurdity, in that a heavy piece of work must be moved to and fro under a cutting tool, which with its holder is comparatively light. The critics say: Why not move the tool and its holder over the work?

It is often said that the link motion of a locomotive is one of the most imperfect devices ever put upon a machine, but it must be considered that if any device existed that would fulfill

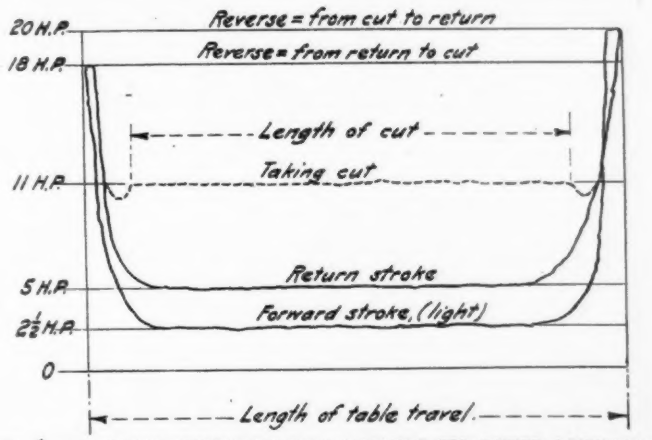



FIG. 1.—DIAGRAM INDICATING THE DEMANDS FOR POWER OCCURRING IN A PLANER DRIVE DURING A CYCLE OF ITS OPERATION.

in a better manner all of the requirements of the link motion, it would have been generally adopted long ago. So it is with the planing machine, the faults of which are generally admitted, but until some better method of handling such work is devised it will continue pulling and pushing the work under the tool.

The conditions to be considered when arranging for a planing machine drive are as follows: A heavy platen or table with the work secured to it is first to be moved under the cutting tool; then the forward motion must cease and the direction of motion be reversed; and then the platen and all of its driving parts must be moved in the opposite direction, at as high a rate of speed as possible. The older type of planing machines usually were operated with cutting speeds of anywhere from 16 to 24 ft. per minute, and return speeds of about double the cutting speeds. Within recent years, however, much higher cutting speeds have come into use, until, for cast iron, 30 or 40 ft. for roughing, and from 40 to 60 ft. per minute for finishing cuts are not uncommon. The reverse speed also has in many instances been very much increased. The amount of increased speed and the successful operation of the same varies greatly with the different types and makes of planing machines.

It is the intention at the present time, however, to go into a study of the merits of the various types of driving of this class of machine tools by electric motors. The conditions to be met are, as above stated, a platen and its load to be moved under the cutting tool, then reversed and returned. This cycle of operations may be very comprehensively illustrated, in a general way, by a diagram, the diagram to be laid out with horizontal lines at heights which will represent proportionally to a scale the amount of power required for each operation of the cycle. Such a diagram is presented in Fig. 1. The curves of change from one line to the other are drawn approximately only; to get a correct curve from such an action it would be necessary to have an elaborate form of recording apparatus. The diagram shown represents the power required by a certain planer and is given only as an example.

The power required to move the platen forward with no cut was 2½-h.p. To move the platen through return motion at three times the cutting speed, 5-h.p. were used. At the moment of reverse from forward to return the power used increased suddenly to 20-h.p.; at the reversal from return to forward motion the power increased to 18-h.p. With this particular machine the gross power required to take the cut during a test was 11-h.p. The motor used was rated at 10-h.p.

While this diagram is not an accurate representation, it serves to show graphically the varying power demands upon the motor. It will be noticed that twice during one cycle of the platen's movement, the motor must furnish about double its power capacity. The motor may stand this all right, but if it does not then additional power must be furnished momentarily from some other source. Again, if the motor does stand the extra load all right, the excess amount of energy suddenly demanded by the motor may produce detrimental effect elsewhere in the power circuit. In either case, the extra power needed may be most easily provided by a fly-wheel placed upon the motor shaft or upon some part that is driven by the motor.

Most planer builders recognize the need of such a device

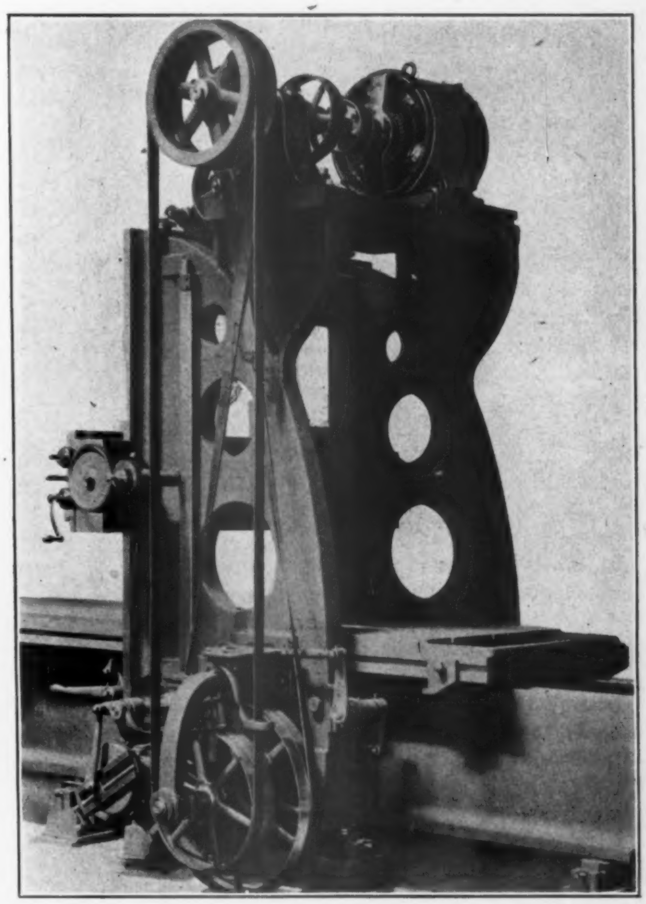


FIG. 2.—DIRECT-CONNECTED MOTOR-DRIVE UPON A GRAY PLANER, SHOWING USE OF FLYWHEEL. BULLOCK CONSTANT SPEED MOTOR.

and provide for it in some suitable manner. But the question as to how to apply a motor to a planing machine is regulated sometimes by the buyer, and sometimes by the builder; and the lack of uniformity as to sizes and speeds, for motors having the same power rating, leads to corresponding lack of harmony in their application.

Theoretically the correct plan would be to have a reversible, variable-speed motor attached directly to the gearing of the planer, the stopping, reversing and restarting of the motor to be accomplished by means similar to the usual device used for shifting the belts of the present type of machine. A device of this kind offers many advantages, and some years ago one was patented, but it has never been tried to any extent in prac-

tice. Obviously the practical objections to this desirable plan are very great.

The general practice at the present time is to retain the usual design of planer with belt driving and shifting mechanism, with the belts driven from a motor-drive countershaft. The question is, as to what is the best plan to follow; no universal method can be suggested that will suit all cases or meet all requirements.

There are various ways by which this arrangement can be effected: First, by making the connection between the motor and countershaft direct; this usually requires a motor of special design which will run at the required countershaft speed. This is the simplest method, as by its use all belts, chains or gears can be done away with. The second method is for the motor to drive the countershaft by means of chain or gears; this allows the motor and countershaft to be brought close together. A third method becomes desirable if the motor is to be placed at some distance from the countershaft, when the connection may be by belt.

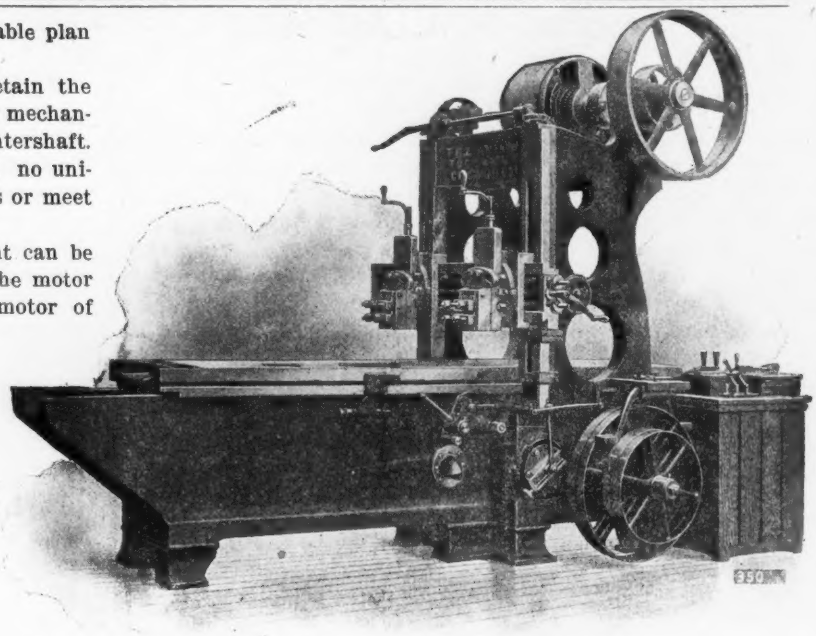


FIG. 3.—DIRECT CONNECTED MOTOR DRIVE UPON A PLANER BUILT BY THE AMERICAN TOOL WORKS COMPANY, SHOWING USE OF FLYWHEEL. BULLOCK CONSTANT-SPEED MOTOR.

With either of these three plans a standard motor can be adopted and run at its rated speed, the speed reduction between motor and countershaft being provided for in the chain, gear or pulley-drive. Whether the lower cost of standard motor, with connecting attachments, renders its selection advisable as against a motor of special design is a question; if the cost were anywhere near equal it would in most cases be best to use the slower speed motor and direct attachment.

The most suitable location for a motor in planer driving will depend upon existing conditions. Where a machine already in use is to be changed from belt to motor drive, the motor can be placed upon the ceiling, or upon the floor and belted to the countershaft. Frequently, however, it is desirable to have the head room free for cranes, etc., in which case the motor can be set upon brackets secured to the housings of the planer. Many of the points above noted are illustrated by the accompanying views of motor-drive applications to planers.

Fig. 2 shows a spur-gear driven planer, built by the G. A. Gray Company, Cincinnati, Ohio, as arranged for motor driving. This machine has the motor, a Bullock motor operating at a constant-speed, located upon a platform which is carried by brackets that are cast integral with the housings. The usual form of countershaft is here replaced by one that is coupled directly to the motor. This shaft carries the pulley for operating the crossrail elevating mechanism, as well as those for driving the machine. In this case the motor is of a special design to run at a speed to suit the countershaft.

One advantage of placing the motor in the position shown is that it is out of the way, and there is no danger of dirt and chips being swept into it. From a critical standpoint it might be said that the overhang of the driving pulleys outside of the bearing was objectionable, but this can be met by use of a sufficiently long bearing and a shaft of sufficient diameter, as is evidently done in this case. The use of one of the driving pulleys as a balance wheel to assist the motor is the noticeable feature of this drive. Taken altogether the entire design of this drive forms a very neat and compact arrangement.

In Fig. 3 is presented an illustration of a motor driving application to a planer built by the American Tool Works Company, Cincinnati, Ohio. In this drive also the motor is direct-connected to the countershaft, so that the above considerations referring to the planer in Fig. 2 are applicable here also. The motor used in this case is likewise a Bullock constant-speed direct-current motor, and the pulley forms a heavy flywheel to assist the motor at reversals.

With this machine the switch, starting box and circuit breaker are mounted upon a stand placed in the rear of the driving pulleys. It would seem to be more convenient if, with any of these drives, the switch and starting box could be placed upon the side of bed near the reverse lever and properly protected from dirt. In this position they would be within easy reach of the operator.

Fig. 4 shows a drive upon a Gray planer in which a silent chain is used as the connection between the motor and countershaft. As before mentioned, this arrangement allows the use of a standard motor of high or moderate speed, the reduction in speed being provided for by making the sprocket wheels of the proper ratio. The difference in cost between a standard motor, with the extra cost of chain, or gears, etc., may be enough less than a special motor to justify the use of the standard type; but all other things being equal or nearly so, the direct connection from the special motor seems to be the better plan.

In this case a General Electric direct-current motor is used. The countershaft is carried by inverted hangers upon a platform supported by the housings.

With a spiral geared planer the driving pulleys are set with their axis parallel to the bed and platen, and the arrangement of motor must be somewhat different from that of the above

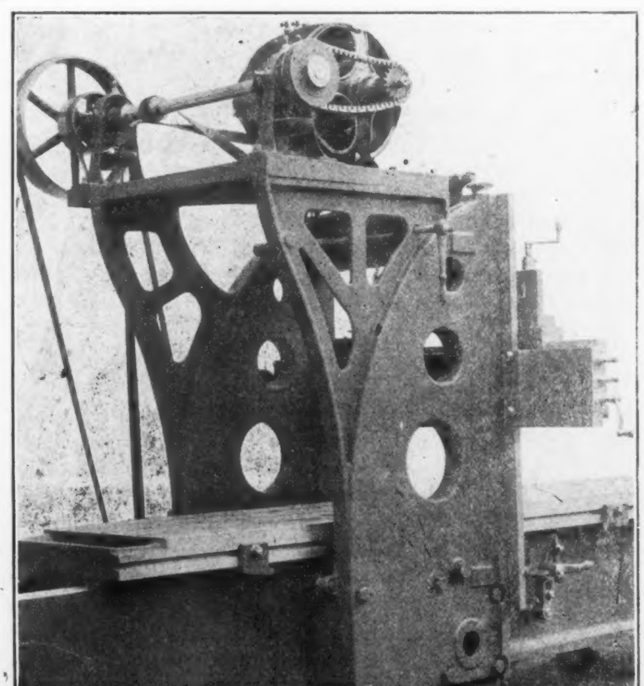


FIG. 4.—A MOTOR APPLICATION TO A GRAY PLANER, USING THE CHAIN-DRIVE. GENERAL ELECTRIC MOTOR.

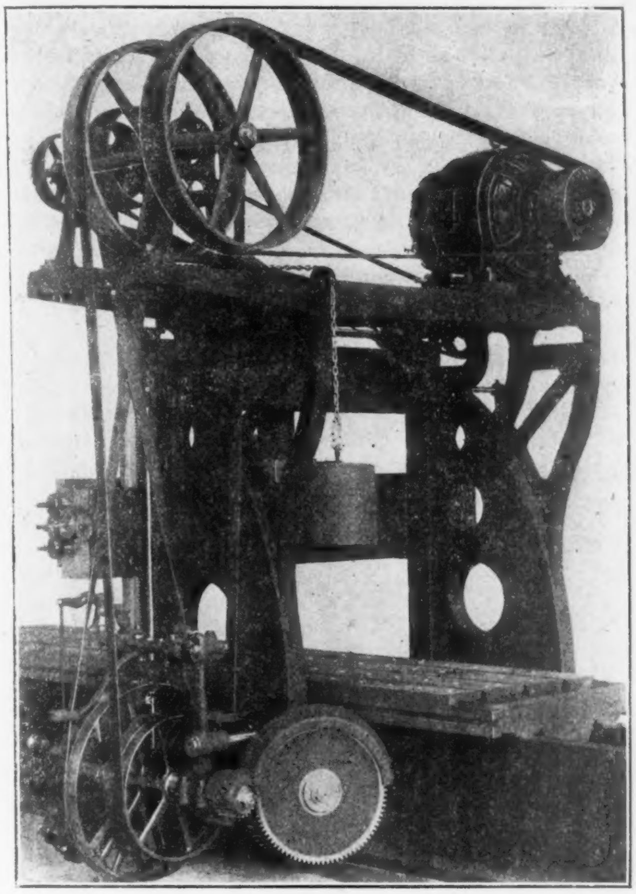


FIG. 5.—BELTED DRIVE UPON A GRAY PLANER—FLYWHEELS STILL RETAINED. JANTZ & LEIST CONSTANT-SPEED MOTOR.

types. Fig. 5 shows a planer of this class, also built by the G. A. Gray Company, with the motor belted to the countershaft. The motor, in this case a Jantz & Leist constant-speed motor, ..ts upon a sub-base and can be adjusted for taking up the slack of the belt. With this arrangement the belt can be cemented instead of laced, so that it will run smoother than otherwise. While the belt drive is probably cheaper than the

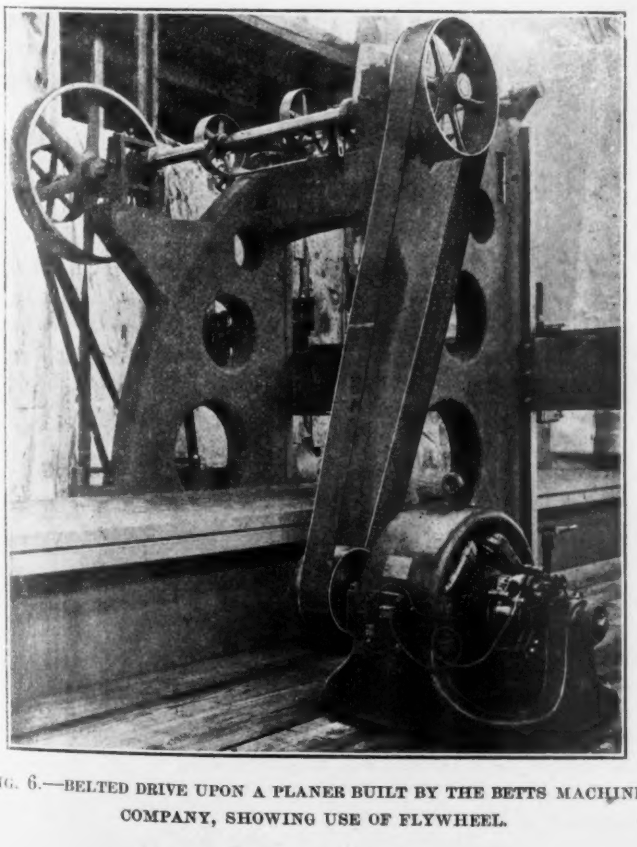


FIG. 6.—BELTED DRIVE UPON A PLANER BUILT BY THE BETTS MACHINE COMPANY, SHOWING USE OF FLYWHEEL.

chain or gear drive, it requires more attention than either of the others.

It will be noticed also that with the three above described arrangements, an advantage is gained in that the supporting brackets can be utilized as supports for the counterweights when side heads are used, making a more sightly appearance than when they are carried up to the ceiling. The latter style of drive does not have the compactness of that shown in Fig. 2, however, the difference being accounted for by the difference in design of the two machines.

For belted drives, that shown in Fig. 6 is undoubtedly more desirable. In this application, which is upon a planer built by the Betts Machine Company, Wilmington, Del., the motor is set upon the floor and belted up to the countershaft. The countershaft is here supported by inverted hangers carried upon brackets cast upon the housings. It will be noticed here

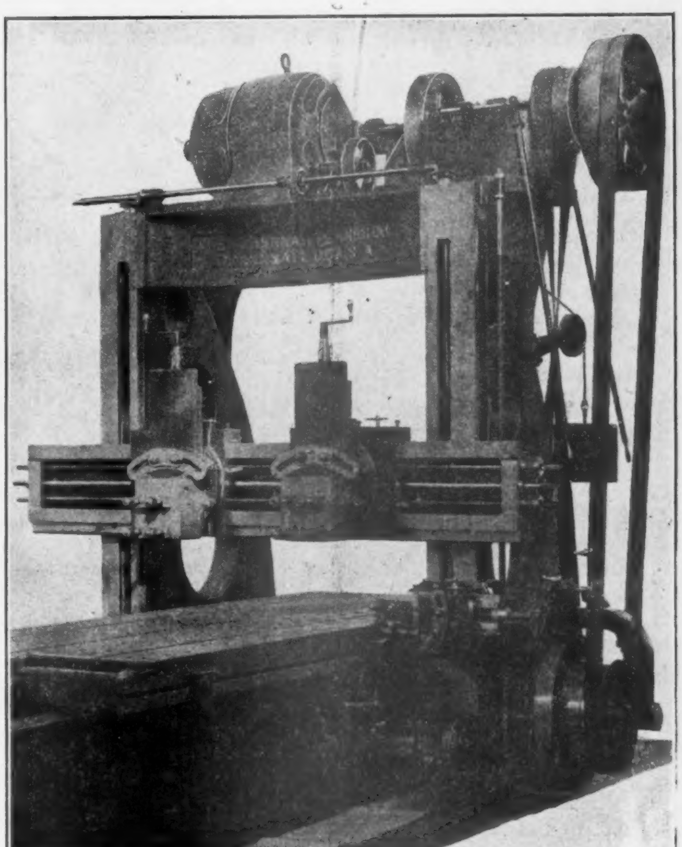


FIG. 7.—GEARED DRIVE UPON A PLANER BUILT BY THE CINCINNATI PLANER COMPANY, USING GEAR BOX FURNISHING VARIABLE CUTTING SPEEDS AND CONSTANT RETURN. JANTZ & LEIST CONSTANT-SPEED MOTOR.

also that a pulley with a heavy rim is used to obtain the flywheel effect to assist the motor at reversals.

One feature in connection with planer driving is not usually given the attention it deserves—that is a variable cutting speed to the platen. Usually when this is provided for, the return speed is affected also, but it should not be the case, as too high a return speed frequently makes trouble. There are devices upon the market by use of which the cutting speed can be made variable, while the return speed is constant; this is the proper method. With the motor drive this result may be obtained in several ways.

Figs. 7 and 8 illustrate a motor-driven planer of the Cincinnati Planer Company, Cincinnati, Ohio, which is equipped with the device for giving a variable cutting speed and a constant rate of return speed. The device consists essentially of a gear box containing a set of driving and driven gears of different ratios, which are used in connection with the usual pulleys for driving the platen forward and back.

The connections between the gears are changed by means of the two levers shown at the side of the machine in Fig. 7.

The advantage which comes from thus being able to change the cutting speed to suit a varying class of work should be readily apparent. While many planers used upon a regular line of work are all right with but one speed, there are many cases where a variable speed machine can be used with profit.

The motor in this case can be of standard design and runs

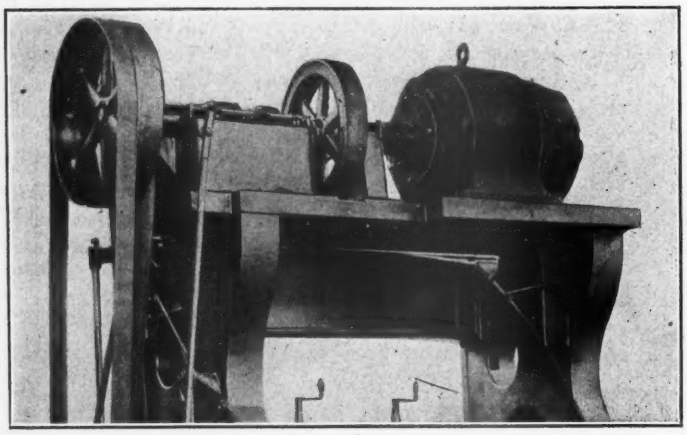


FIG. 8.—REAR VIEW OF THE GEARED DRIVE UPON THE CINCINNATI PLANER, SHOWING GEAR BOX, AND ALSO THE HEAVY FLYWHEEL.

at a constant speed, and is connected to the rear or constant-speed shaft by gears that are proportioned to give the desired rate of return speed to the platen. Besides the return driving pulley, an unusually heavy fly-wheel is also located upon this shaft.

The subject of motor driving is comparatively a new one, and, while both the users and the builders are doing all they can to arrive at the best results, we must look to the future for a satisfactory solution of the problem.

## WATER SOFTENING—UNION PACIFIC RAILWAY.

Important records, obtained in the use of eleven Kennicott water softeners on the Union Pacific, were placed before the Associations of Superintendents of Bridges and Buildings at their recent convention in the following report, showing the actual results. This report is signed by Mr. J. B. Berry, chief engineer of the road. A noteworthy feature is the plain statement of cost as presented in the accompanying table.

magnesia and the non-incrusting solid sodium sulphate. The water from each station to be treated is analyzed and solutions are prepared of the proper strength for treating these waters. These solutions are introduced automatically into the untreated water in the proper proportion for the volume of water passing through the softener. As time is an important feature in chemical reaction, the water towers are constructed of a size to allow ample time for reaction in passing through the tower. The treated water flows off through a pipe at the top of the tower to the regular railway storage plant.

"The cost of chemicals for treating waters will vary with the analysis. By referring to the table, you will note that this cost varies from 0.3 to 3.6 cents. In the ten plants we are treating 1,441,000 gallons per day at an average cost of 1⅛ cents per thousand. By referring to the table you will note that the waters containing the larger quantities of sulphates of lime and magnesia are the most expensive to treat. At the same time it is worth more to remove these sulphates of lime and magnesia, as they form the hardest scale and are the most difficult to remove from boilers. The additional cost for labor is but little, one man being added to the rolls as an assistant to the chemist and whose duty it is to keep on the road visiting the various softeners and seeing that they are properly attended to. The preparation of solutions is attended to by the regular pumpers at all except gravity supplies and where city water is used. At such places some other employee is delegated to attend to this matter, as it does not take more than half an hour daily at the largest plants.

"The saving in boiler repairs certainly warrants the expenditure of the amount necessary to treat the waters at all points where we either have or are erecting water softeners. Another saving is in locomotive fuel, which will be no small item as the evaporative power of boilers will be increased or, as locomotive firemen express it, "she steams easier."

"The value of treating will depend on the quantity of water used daily and the character of such water. While we have been unable to state in exact figures the saving to the company, we are satisfied that at any point where 75 pounds or more of incrusting solids can be removed from the water daily, it is an economy to treat such water.

"Referring to the table again, in the ten plants we are removing 2,790 pounds of solids per day. Cost of chemicals for this work is 58¼ cents per hundred pounds of incrusting solids removed. Even though this figure were doubled it would still be an economy, as any experienced man knows that 100 pounds

UNION PACIFIC RAILROAD.

Statement Showing Results Obtained in Treating Waters for Boilers, Giving Analyses Before and After Treating, in Grains per Gallon, and Pounds Incrusting Solids Removed Daily at Each Plant.

| | Council Bluffs, Ia. | | Valley, Neb. | | Columbus, Neb. | | Grand Island, Neb. | | Kearney, Neb. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Before. | After. | Before. | After. | Before. | After. | Before. | After. | Before. | After. |
| Silica | 1.97 | 1.57 | 1.73 | 1.81 | 2.54 | 1.84 | 1.49 | 1.52 | 2.42 | 2.00 |
| Oxides of iron and aluminum | 2.33 | .36 | .13 | .06 | .44 | .47 | .44 | .21 | .20 | .15 |
| Calcium carbonate | 14.19 | 1.48 | 6.52 | 1.93 | 14.22 | 1.20 | 5.42 | 2.50 | 10.01 | 1.33 |
| Calcium sulphate | 8.32 | ... | 1.19 | ... | 1.67 | ... | 1.86 | ... | 1.10 | ... |
| Magnesium carbonate | .84 | 1.50 | 1.46 | .54 | 2.94 | 1.43 | .79 | .54 | 2.24 | 1.26 |
| Magnesium sulphate | 10.35 | ... | .95 | ... | 2.81 | ... | 1.41 | ... | .38 | ... |
| Total incrusting solids | 38.00 | 4.91 | 11.98 | 4.34 | 24.62 | 4.94 | 11.41 | 4.77 | 16.35 | 4.74 |
| Non-incrusting solids | 9.00 | 29.37 | 3.74 | 5.38 | 6.12 | 15.61 | 2.10 | 7.88 | 5.33 | 10.28 |
| Total solids | 47.00 | 34.28 | 15.72 | 9.72 | 30.74 | 20.55 | 13.51 | 12.65 | 21.68 | 15.02 |
| Cost of chemicals per 1,000 gals. | 3.6 cts. | | 0.4 cts. | | 1.3 cts. | | 0.9 cts. | | 1.1 cts. | |
| Gallons water treated per day | 130,000 | | 89,000 | | 140,000 | | 180,000 | | 56,000 | |
| Incrusting solids removed per day | 615 lbs. | | 96 lbs. | | 393 lbs. | | 171 lbs. | | 93 lbs. | |

| | North Platte, Neb. | | Julesburg, Colo. | | Sidney, Neb. | | Cheyenne, Wyo. | | Point of Rocks, Wyo. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Before. | After. | Before. | After. | Before. | After. | Before. | After. | Before. | After. |
| Silica | 2.86 | 2.01 | 2.83 | 2.27 | 3.17 | 2.92 | 2.42 | 2.19 | 1.92 | .63 |
| Oxides of iron and aluminum | .26 | .26 | .11 | .35 | .44 | .12 | .14 | .15 | .39 | .20 |
| Calcium carbonate | 7.94 | 1.98 | 7.40 | 1.28 | 6.68 | 1.45 | 9.29 | 1.31 | 8.19 | 2.55 |
| Calcium sulphate | 4.53 | ... | 2.10 | ... | 2.14 | ... | ... | ... | ... | ... |
| Magnesium carbonate | 1.35 | 1.08 | 3.56 | .96 | 2.16 | .44 | 2.34 | .91 | 4.08 | .88 |
| Magnesium sulphate | 2.43 | ... | 1.74 | ... | .44 | ... | ... | ... | 3.47 | ... |
| Total incrusting solids | 19.37 | 5.33 | 17.74 | 4.86 | 15.03 | 4.93 | 14.19 | 4.56 | 18.05 | 4.26 |
| Non-incrusting solids | 9.12 | 19.89 | 7.52 | 13.93 | 1.78 | 10.47 | 2.46 | 3.91 | 23.74 | 27.26 |
| Total solids | 28.49 | 25.22 | 25.26 | 18.79 | 16.81 | 15.40 | 16.65 | 8.47 | 41.79 | 31.52 |
| Cost of chemicals per 1,000 gals. | 1.2 cts. | | 1.3 cts. | | 0.9 cts. | | 0.3 cts. | | 1.0 cts. | |
| Gallons water treated per day | 170,000 | | 122,000 | | 140,000 | | 270,000 | | 144,000 | |
| Incrusting solids removed per day | 340 lbs. | | 224 lbs. | | 202 lbs. | | 372 lbs. | | 284 lbs. | |

"We have in operation on the Union Pacific Railroad eleven Kennicott water softeners, varying in size from a capacity of 8,000 gallons per hour to 20,000 gallons, and are erecting twenty-five more softeners at the rate of about three per month. I enclose herewith a table showing the results obtained at ten of the plants that have been established for some time.

"The water is treated by the cheapest of chemicals, common lime being used to precipitate the carbonates of lime and magnesia, which are held in solution because of carbonic acid in the water; soda ash is used to react on the sulphates of lime and magnesia, producing the insoluble carbonates of lime and

of scale cannot be removed from boilers for any such figure.

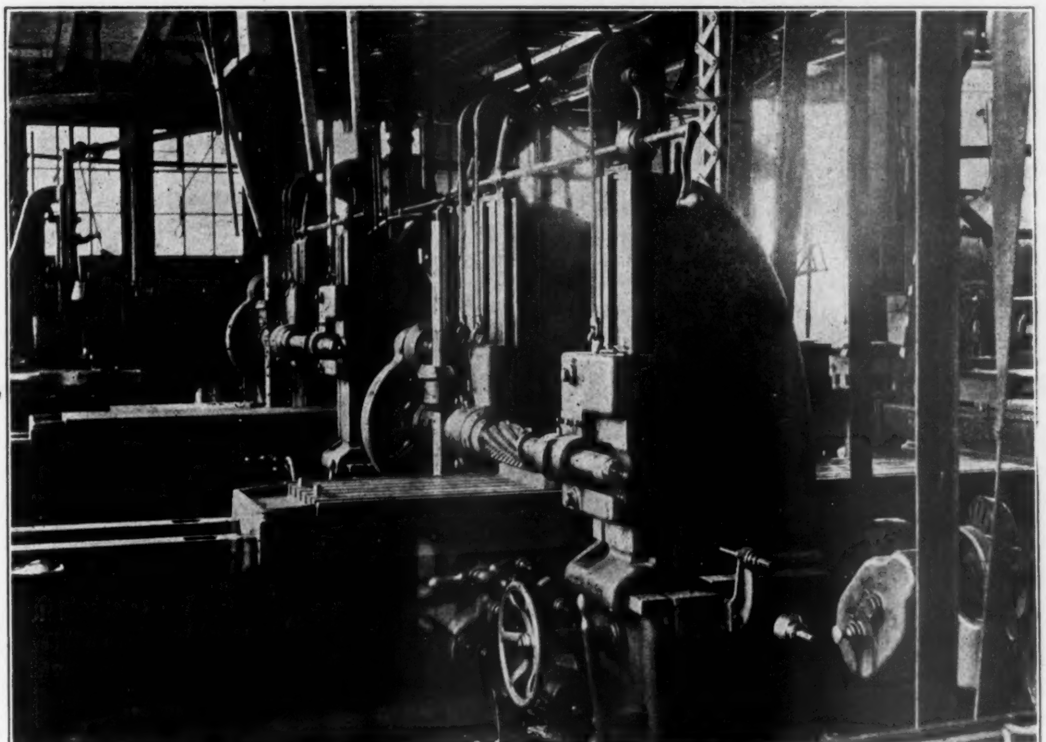
"The analyses of water shown in the table were made in the laboratory of the Union Pacific Railroad and show the average results we are obtaining when plants are properly looked after. Weekly analyses are made in order to keep check on the employees and see that they are properly attending to their duties. Besides this check, the traveling assistant to the chemist is liable to visit the plants at any time without giving notice and, as he is provided with a simple outfit for making tests, the character of the work is kept up to a good standard.

## THE PLANER-TYPE MILLING MACHINE IN RAILROAD SHOPS.

TOPEKA SHOPS.—ATCHISON, TOPEKA & SANTA FE RAILROAD.

The recent increasing use of the slab milling machine in the railroad shops of this country is worthy of note as attesting the interest that is being taken in improving machine shop performances and securing increased outputs. For many classes of work such as the surfacing of side rod and other large forgings of steel, this horizontal type of milling machine is most efficient and rapid; with the inserted tooth milling cutter, results are being obtained with this class of tool which cannot even be paralleled by the planer.

In the accompanying engraving we present a view of a portion of the heavy tool section of the new Topeka shops of the Santa Fe, showing two large planer type milling machines which were built by the Becker-Brainard Milling Machine Company, Hyde Park, Mass. Owing to the importance of the classes of work to which these tools are applicable, a description of them will be of interest.



VIEW OF THE TWO 26 BY 32 INS. BECKER-BRAINARD PLANER-TYPE MILLING MACHINES AT THE TOPEKA SHOPS.—ATCHISON, TOPEKA & SANTA FE RAILWAY.

These two machines are both the standard 32 ins. by 26 ins. by 10-ft. bed horizontal milling machines of the Becker-Brainard Company, which are especially designed for the extremely severe work that is encountered in railroad shops. This design of tool is intended to fulfill the most exacting requirements of the new high-speed tool steels and withstand the heaviest modern machining operations. It is of very heavy construction, strength, rigidity and power being aimed at. The bed is extra deep, extending to the floor for a solid foundation, and is securely braced by heavy cross girders inside, evenly spaced.

The spindle is 5 ins. in diameter, of hammered crucible steel, has a threaded nose and runs in self-centering bronze boxes with an adjustment to compensate for wear. The spindle carrier is very heavy and is held firmly to the upright by long gibs. It is elevated by a screw with adjustable dials graduated to thousandths of an inch and has counterbalance for ease of operation. The spindle is driven by a 5-in. belt on a five-step cone, giving gear ratios of 13½ and 27 to 1. By means of a hand lever and quick change gearing the speed is easily adjusted, 20 changes of speed being thus available.

The table is of a very heavy design, and is built with five T slots lengthwise and an oil channel the full length and at each end. It travels on flat ways with heavy gibs, and has a quick return motion operated by power from a separate countershaft; it can also be moved by the usual hand wheel.

The feed motion of the table is operated directly through a positive gearing drive from the main driving cone, giving a range of feed through eight changes from 3-64 to 3-8 ins. These changes of feed can be made instantly by means of a lever without stopping the machine.

The principal dimensions of this interesting type of tool are presented below:

SPECIFICATIONS:

| | |
|---|---|
| Working surface of platen | 120 ins. x 26 ins. |
| Length of bed | 168 ins. |
| Longitudinal feed, automatic in both directions | 120 ins. |
| Greatest distance from center of spindle to table | 28 ins. |
| Least distance from center of spindle to table | 2 ins. |
| Greatest distance from end of spindle to center of table | 16⅝ ins. |
| Least distance from end of spindle to center of table | 6¾ ins. |
| Greatest distance from end of spindle to tail stock spindle | 37 ins. |
| Least distance from end of spindle to tail stock spindle | 17 ins. |
| Net weight | 25,000 lbs. |

## THE MACHINE TOOL OUTLOOK FOR 1904.

With the large number of improvements that are planned for this year by the railroads, little apprehension need be felt for a continued activity of the machinery trade among railroad shops. A large number of shops are now either in process of erection or rebuilding, and will be completed ready for the machinery in the early part of this year; on the other hand, in several instances, large appropriations for shop expenditures and for large renewals of machine tools, which have been deferred until 1904, will soon be acted upon.

The Pennsylvania Railroad Company have extensive improvements under way and are planning for still more. Extensive repair shops are under construction at Fairview, opposite Harrisburg, Pa.; it is estimated that the buildings alone for this installation will cost about $500,000. A new wheel shop and a large foundry are being built at Burket's Station, near Altoona, Pa., the principal building to be over 600 feet long.

Extensive repair shops are also planned for the New York division of the Pennsylvania, at Trenton, N. J., where a large site was purchased last year. At Wilmington, Del., the new shops in connection with the Philadelphia, Baltimore and Washington system are nearing completion and need a large

amount of machinery. These are the more prominent points connected with the shop extension plan of this system which will require immediate action as to equipment this spring. Very little machinery has been purchased during the last six months in relation to the extent of the shop improvements that have been instituted on this system.

The purchases which the Erie Railroad Company have made during the latter half of last year are said to have been but a small portion of what is planned in the way of the improvement of the shop system of this road. As will be remembered, $10,000,000 was appropriated last year for improvements on the Erie. A similar amount was likewise appropriated by the Union Pacific, which road is said to be considering an elaborate scheme for shop extensions.

The large new shops in process of construction at Sayre, Pa., for the Lehigh Valley Railroad have not been provided for as to machine tools, although the traveling cranes, the power plant equipment and other important features were purchased a short time ago. The Delaware, Lackawanna & Western Railroad will also be in the market for an elaborate machinery equipment for their new car shops; the buildings are being erected at a cost of some $750,000.

Only a small portion of the equipment needed for shop improvements now under way has been purchased by the Southern Railway; this company is erecting new shops at Knoxville and Spencer, but the appropriations for the necessary machinery have so far been deferred. Specifications were issued several months ago for machine tools to cover the equipment of five large shops. The Seaboard Air Line have plans for a large shop which was deferred until this year. Their plan is to establish a system of repair, and car and locomotive-building shops at Atlanta, Ga., of a size sufficient to take care of their entire line.

The Louisville & Nashville Railroad Company have purchased a portion of the necessary machine tool equipment for their large shops which are now in process of construction at Louisville, Ky. This is a very large shop involving the most modern construction and will require an immense equipment. The steel work of several of the more important shop buildings is now completed and work will be pushed to completion early this year. This will be one of the most important railroad shops in this country.

It is expected that the New York Central and its allied lines will require a large amount of machine tool equipment as a result of their desision to modernize all of their repair shops and standardize all of their equipment, track materials, etc. Mr. J. F. Deems, general superintendent of motive power, rolling stock and machinery, is carrying out this plan. He has spent a great deal of his time visiting the various shops along the system and, while small changes have been made at various points, the work has only faily begun.

The Denver & Rio Grande Railroad system are planning to enlarge their shops at Salt Lake City, Utah, and it is reported that they will expend some $200,000. It is also stated that Wm. O. Herin, superintendent of machinery and equipment of the Missouri, Kansas & Texas Railway system, located at Parsons, Kan., has prepared extensive plans for the enlargement of the shops at Parsons. This matter is scheduled to come up for decision early this year. The rebuilding of the large shops of the Père Marquette Railroad Company, at Saginaw, Mich., was deferred until next spring, when it will probably be taken up and carried through to completion.

It is said that a large shop will be erected at Allendale, Ontario, by the Grand Trunk System, which will require a large amount of new equipment. The Wabash Railroad are also to build shops in Canada, and J. B. Barnes, superintendent of motive power and machinery, Springfield, Ill., is preparing the plans. The Chesapeake & Ohio have a project for the establishment of new shops at Clifton Forge, Va., which is said to be another case of holding back for a 1904 appropriation.

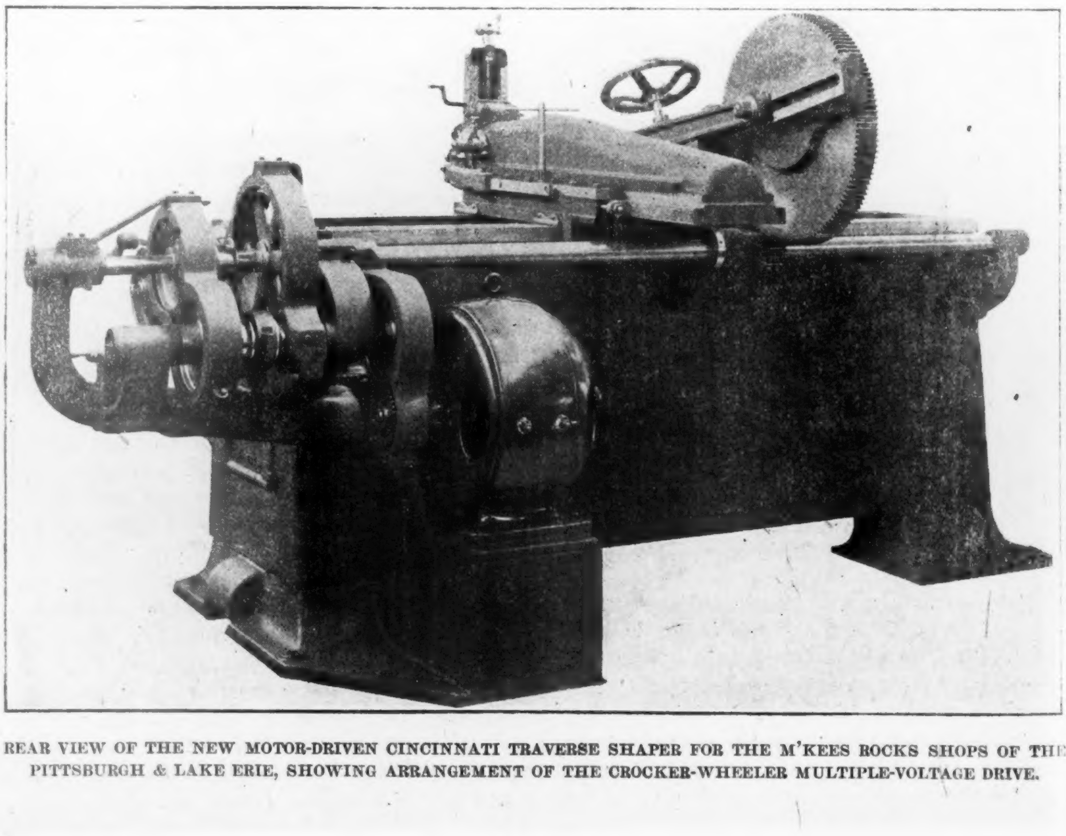
The large new car building plant, which has been under consideration by the Armour Car Lines of Chicago, is now under way. This embraces the installation of a complete shop system for the building of cars. Another car plant for which a great deal of machinery will be purchased in the near future will be built at Henderson, Ky., by the newly formed Henderson Car Works Company of that city. It is also said that the Central Car & Foundry Company will expend $200,000 on a car building plant at Vincennes, Ind., to have a large capacity for building and repairing cars.

## MULTIPLE VOLTAGE DRIVING FOR A SINGLE-HEAD TRAVERSE SHAPER.

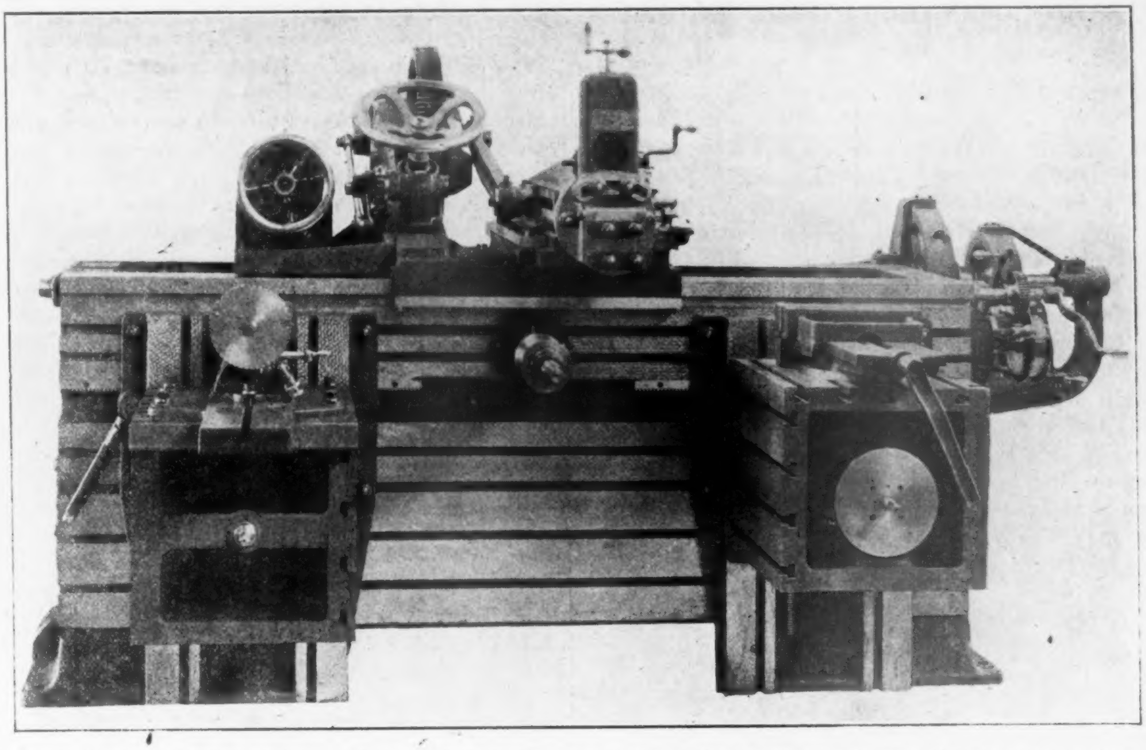
McKees Rocks Shops.—Pittsburg & Lake Erie.

In view of the very interesting series of articles by Mr. R. V. Wright, which are appearing in this journal, descriptive of the methods used for equipping the old tools at the McKees Rocks shops of the Pittsburgh & Lake Erie, these two accompanying illustrations will be of interest. These views present an interesting special design of motor driving for a single-head traverse shaper, which was built for the new McKees Rocks shops by the Cincinnati Shaper Company, Cincinnati, O., who applied to the same a convenient and neat arrangement of motor driving as shown.

Particular attention should be given to the compact arrangement of the motor and driving connections, as well as also to the arrangement of the controller for varying the speed of the motor; this arrangement of the controller upon the head is admirable for not only its convenience to the operator, but also



REAR VIEW OF THE NEW MOTOR-DRIVEN CINCINNATI TRAVERSE SHAPER FOR THE M'KEES ROCKS SHOPS OF THE PITTSBURGH & LAKE ERIE, SHOWING ARRANGEMENT OF THE CROCKER-WHEELER MULTIPLE-VOLTAGE DRIVE.



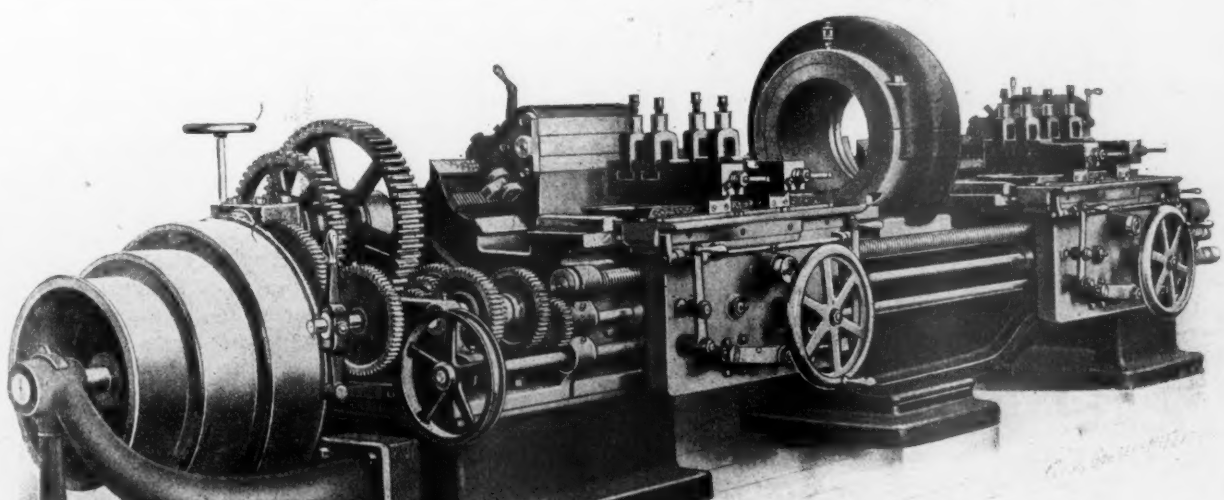
THE NEW 24-IN. TRAVERSE SHAPER, WITH CROCKER-WHEELER MULTIPLE-VOLTAGE DRIVE, FOR THE M'KEES ROCKS SHOPS OF THE PITTSBURGH & LAKE ERIE RAILROAD.—CINCINNATI SHAPER COMPANY.

for its unobtrusiveness in that position. This feature contributes greatly to the rapid and economical handling of the tool. This is undoubtedly one of the neatest motor drives that we have seen applied to a shaper.

The motor used on this tool is a Crocker-Wheeler 7 horsepower variable speed motor operating upon the 4-wire multiple voltage system. It is attached to the base at the rear of the machine as shown in the photograph. The pinion on the motor shaft meshes with a gear on an intermediate shaft, carrying a positive clutch, which may be thrown into one or the other of the two sets of gears, connecting with the driving shaft of the shaper, thus furnishing two runs of speeds. This is very clearly shown in the photograph.

The controller for the motor is mounted on a bracket attached to the saddle, as shown in the front view of the machine. With this method of attaching the controller the operator has full control of the machine when standing in position in front of it, as on this shaper all the feeds are operated directly from the saddle.

This tool, which is the standard 24-in. by 8-ft. traverse shaper, with single head, built by the Cincinnati Shaper Company, is of a very heavy and rigid design. The principal features of the traverse shapers built by this company were referred to in an article on page 425 of our November (1903) issue. The ram is operated by a Whitworth motion, giving a quick return, and is easily and quickly adjusted for length of stroke and position over work. The aprons are rigid, having a full bearing on the face of the bed, and the two tables have vertical adjustments upon the apron. One of the tables is arranged to swivel through an arc of 90 degrees for circular shaping and has a worm feed.



NEW RAPID-REDUCTION DOUBLE-END AXLE LATHE FOR THE READING SHOPS OF THE PHILADELPHIA & READING RAILWAY.—LODGE & SHIPLEY MACHINE TOOL COMPANY (SEE NEXT PAGE).

## A NEW RAPID REDUCTION DOUBLE-END AXLE LATHE.

THE LODGE & SHIPLEY MACHINE TOOL COMPANY.

The accompanying engravings illustrate a double end axle lathe of an entirely new design, which has recently been built by the Lodge & Shipley Machine Tool Company, Cincinnati, O., for the Philadelphia & Reading Railway. It involves many interesting features, departing from usual practice in this class of tools, to which we desire to call attention in detail.

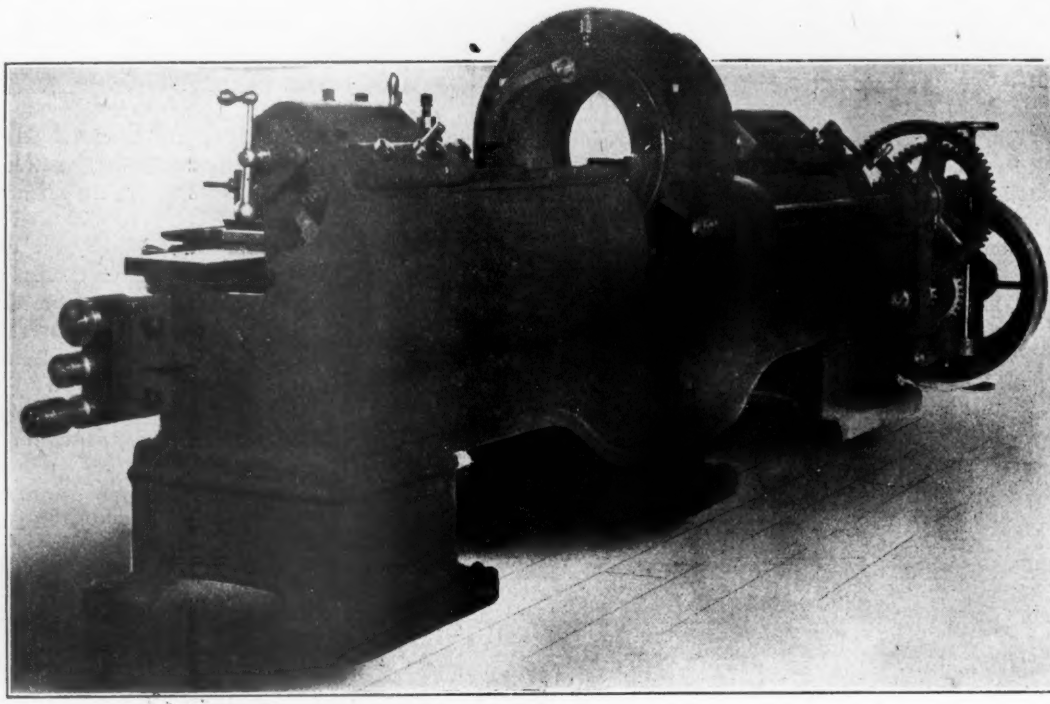
The massive construction of this new tool, which is made apparent in the accompanying engravings, gives evidence of sufficient strength provided to withstand any strain that may be placed upon the machine through the employment of the highest grade tool steels. The rapid reduction idea was also evidently kept in view throughout the entire design.

It may be noted from the illustrations that the bed is of a distinctly new and unique design, providing unusual massiveness and rigidity. Special ways set on an angle of 45 degrees are used for the tail stocks; in this way the upward pull or stress on the tail stock is received directly by the bed and not on clamping bolts. The tail stock spindle or slide is dovetailed directly into the tail stock, and to increase its rigidity is gibbed at both top and bottom.

driving gear are 6.1 to 1 and 20.9 to 1, which, with the three changes on the cone pulley, gives six cutting speeds.

The carriages are arranged to take one or more tools, which can be placed anywhere along their length and at varying distances apart. The feed, instead of being obtained through a rack and pinion, is provided by a bronze nut 14 ins. long, which completely encircles a stationary lead screw, with double thread of 1-in. lead. By revolving the nut on this screw a more powerful feed is obtained, and greater wearing qualities are obtained, than by the rack and pinion movement. The nut is revolved for the regular feed by a feed rod driven by gears from the cone pulley shaft. Another feed rod directly under this runs constantly at a high speed, being driven by an independent belt, and affords a means of moving the carriage rapidly in either direction by power instead of the slow and laborious method of the hand wheel.

At the front of the apron are three levers; the one at the left starts or stops the feed; the lever at the bottom is for reversing, and that at the right applies the quick movement to the carriage. A safety device is provided in the apron to prevent both the feed for turning, and that for the quick movement, being engaged at the same time. Automatic stops are provided in both directions for each carriage, and calipering stops can be applied to each tool for duplicating diameters; this combination does away with considerable measuring and calipering.



REAR VIEW OF THE LODGE & SHIPLEY DOUBLE-END AXLE LATHE, SHOWING THE UNUSUALLY HEAVY CONSTRUCTION OF THE BED AND BRACING FOR THE INCLINED TAIL STOCK WAYS.

The carriages are provided with separate ways from those used for the tail stocks, and are calculated to properly take care of the heavy stresses in cutting directly.

Throughout the entire length of the bed are four vertical beams, or webs, so placed that the thrusts on the tail stock act up through the two rear webs, while the two front webs come directly under the carriage and receive the entire downward pressure of the cutting tool.

The driving mechanism of this tool is particularly of interest. It consists of a three-step cone, having diameters of 20, 25 and 30-ins. by 6½-in. face, and the inner end of its shaft is connected through two changes of gearing directly to a short driving shaft at the rear of the lathe as shown. This driving shaft is geared into the central driving headgear, 30 inches in diam. by 4-in. face, mounted between bearings at the center of the bed. A special equalizing driving plate, having for an extreme a 15-in. opening through the center greatly facilitating the insertion and removal of axles, transfers the power to the axle. The ratios of gearing between the cone pulley shaft and central

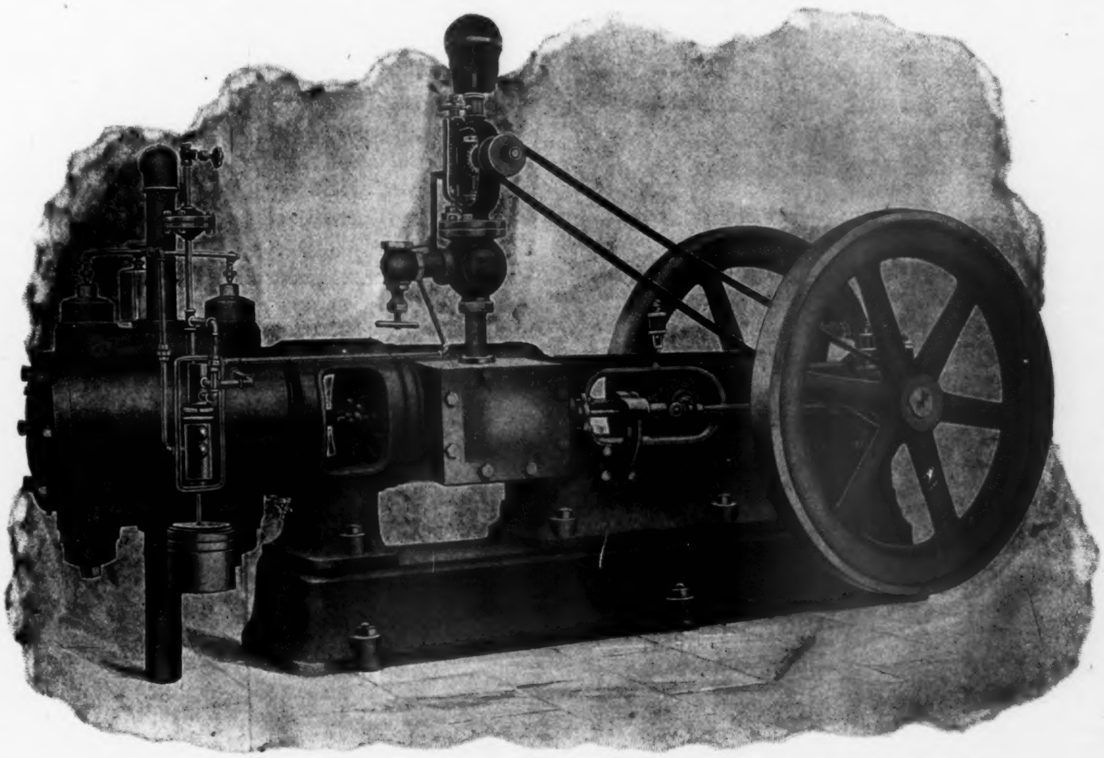
The tail stocks are shaped so as to allow the carriages to pass them when starting a cut at the end of the axle; in using more than one tool this feature is of the greatest importance. A rack and pinion movement facilitates the movement of both tail stocks to accommodate different lengths of axles, and a pawl at the rear of each engaging in this rack, forms a positive lock against outward movement. The tail stock spindle, instead of being round, is made in the form of a dovetail, and a gib is provided at the bottom for taking up wear.

The feeds obtainable on this lathe are six in number, as follows: 3, 5, 8, 11, 16 and 32 to 1 inch, anyone of which can be obtained by a simple movement of a lever at the head of the lathe while the machine is running. All gears, with the exception of the large central driving gear, are cut from steel. Gear covers are provided for the exposed gears and add greatly to the handsome appearance of the machine. This tool is fitted with an oil pump, piping and pan, and a crane for handling the axles. The weight of this lathe, complete with regular counter shaft, oil pump and pan, is about 19,000 pounds.

## A NEW DESIGN OF AIR COMPRESSOR.

CHICAGO PNEUMATIC TOOL COMPANY.

The air compressor shown in the accompanying engraving is a new type of compressor which was recently brought out by the Chicago Pneumatic Tool Company and is being built at their air compressor works at Franklin, Pa. This new compressor is designed to meet the growing demand for an efficient, simple and compact compressor furnished at a moderate price, and represents the highest development in this class of machinery. They are building this form of compressor in a variety of sizes and styles, starting with a minimum capacity of 30 cu. ft. of free air per minute, single, duplex or compound, actuated by steam, belted, chain driven, or geared to an electric motor.



VIEW OF THE NEW TYPE OF AIR COMPRESSOR.—THE CHICAGO PNEUMATIC TOOL COMPANY.

The frame is of box section design, with large factor of safety to withstand the strains when working at maximum load; it is withal graceful in outline, with the style of bored cross-head guide, and enclosed provisions for catching and removing drip from bearings and stuffing boxes. When furnished complete with base, as shown, the compressor is entirely self-contained, obviating the necessity of expert services in erecting, and also reducing the cost of foundations.

The type of steam valves used on cylinders under 12 ins. diameter is the plain slide type, and they are accurately scraped to seat and securely fastened to the rod. When the cylinders are 12 ins. in diameter and larger, the Meyer system of adjustable cut-off valves and gear is provided.

The air valves are of the poppet type, made from high grade steel, having removable seats and guides, easily renewed or repaired and thoroughly guarded from entering cylinder in case of breakage. They are placed radially in cylinder, making them readily accessible, ensuring accurate seating, and reducing wear to a minimum. The air cylinder and its heads are completely water jacketed, with thorough circulation of water, affording equal cooling at all points.

The pistons are of the solid type with cast iron spring rings accurately fitted. The shaft is of the center crank type, with exceptionally heavy crank arms, and is made very heavy of the best open hearth steel. The cross-head is of cast iron with adjustable shoes at top and bottom and the connecting rod is fitted with bronze cross-head pin boxes, having the wedge adjustment; the crank pin end is of the marine type, lined with genuine babbitt metal. The compressor has two balance wheels, one on each side, of sufficient weight to insure smooth operation.

A pressure regulating governor is provided, to automatically control the operation of the compressor in accordance with the demand for air, working in connection with a speed governor for regulating the speed of the engine. An unloading device is provided to relieve the compressor of all load when the desired air pressure is obtained, and automatically cause it to resume delivery when the storage pressure becomes reduced.

These compressors are submitted to a working test before shipment and although designed primarily to supply compressed air power for operating pneumatic tools in railroad shops, machine shops, foundries, shipyards, and stone yards they are equally suitable for actuating rock drills, coal cutters and other machinery in mines, tunnels, and quarries, pumping water by the air lift system and for every other purpose to which compressed air is applied.

## AMERICAN BRAKES IN RUSSIA.

The manner in which the equipment of the Russian railways with American air-brakes received its greatest impetus has not been widely known, and may be of interest. A very serious accident occurred on one of the Russian state railways about the year 1895, when a hand-braked train ran into and telescoped a train that was standing on the track ahead of it, thereby killing several people and doing a great deal of damage. At that time it was the custom of the Government Railway Department to equip only its passenger trains with the air-brake, leaving the freight brakes to be applied by hand. In the course of the inquiry that followed this freight-train disaster, the Emperor asked the Minister of Ways and Communications to explan how it had happened, and that official stated that if the freight service also had been equipped with American automatic air-brakes, the accident would not have occurred. To this the Emperor replied, "Why were they not so equipped?"

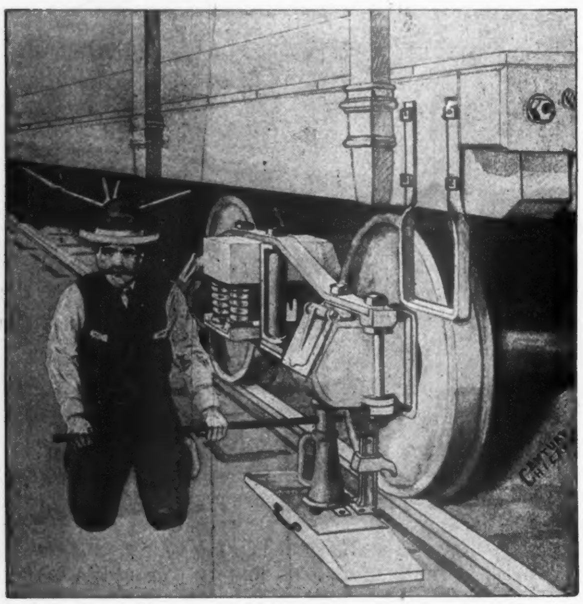
Such a reply from that monarch was equivalent to a command; all the previous troubles in the way of lack of funds were speedily put to the vanishing test, and a commission was formed from the Ministry of Ways and Communications to study up and recommend the best automatic air-brake. After some time this commission decided to put to the test five companies who were competing for the five-year contract for $7,000,000 worth of brakes which the Government needed at that time. They consequently invited each company to send equipments for a 50-car train, which

was to be equipped with each type of brake in turn, and put through the same series of tests. As a result, the Westinghouse air-brake was chosen, and as the Government contract stated that the brakes should be made in Russia, a Westinghouse factory was at once started in St. Petersburg. From the day that the report of the commission was accepted to this the Westinghouse Company has supplied all the railway brakes for the Russian Government. A statement was recently made that a large order for locomotive brakes had been given to a competing American concern, but this is erroneous. The order was for 1,000 sets of Westinghouse locomotive brakes. The policy of the Russian Government demands that all material which is to be used in connection with Government contracts must be made in Russia by a Russian company. There is no other Russian brake company in existence at the present time than the Westinghouse; none other has received a charter.

## THE "HANDY" JOURNAL BOX JACK BLOCK.

FOR THE REMOVAL AND RENEWAL OF JOURNAL BRASSES AND WEDGES.

While the removal of journal bearing and wedges and the insertion of fresh ones is in a way a very simple operation, it often becomes very troublesome because of the lifting of the car-wheel, when the load is lifted by the jack under the journal box. The result of this lifting of the wheel is that the bearing and wedge are not freed so that they can be taken out; the usual procedure under such circumstances is to gather from two to four men to assist the man with the jack-block, bars and levers being required to hold the wheel down so as to free the hot or worn bearings, from all load and permit them to be lifted out, without loss of time, for the insertion of the new bearings. Trains are often delayed and blockades caused by the time consumed in changing bearings on the road. There is

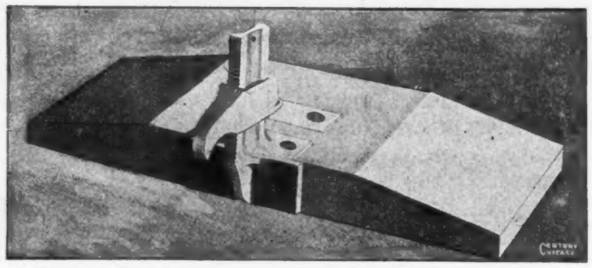


METHOD OF OPERATING THE "HANDY" JOURNAL BOX JACK BLOCK.

also, of course, a great deal of unnecessary time and labor spent in the repair yards in changing bearings with the usual methods.

The device here illustrated is designed to reduce the time and labor in changing bearings both on the road and in yards. It is claimed that one man with any good journal-box jack and with this Handy journal-box jack block can change bearings in from five to ten minutes.

The device consists of a base, or block, of oak, 9 ins. x 2½ ins. x 26 ins., which is intended to rest on the ties or ballast beneath the journal box and carry the journal box jack. On the inner edge of the block a malleable casting is secured by top and bottom flanges for riveting through, which casting has a vertical post with teeth on the edge next to the wheel; fitting loosely over this post is a hook-like piece, as shown, also of malleable iron, having a tooth or lip for engaging with the teeth on the post to prevent it from slipping upwards when the strain is applied—in this way it resists the tendency of the wheel to lift by projecting over and engaging the rim of the wheel. Ample adjustment for varying heights is provided by the teeth extending the full length of the post, for locating the hook at different positions on it. A handle is provided on the opposite



VIEW OF THE "HANDY" JOURNAL BOX JACK BLOCK (WHEEL SIDE).

edge of the block from the post for carrying the device by. Further particulars regarding this interesting and convenient tool can be secured from the manufacturers, the Handy Car Equipment Company, 890 Old Colony Building, Chicago, Ill.

## BOOKS AND PAMPHLETS.

Iron, Steel and Other Alloys; a Treatise on Alloys. By Henry M. Howe, Professor of Metallurgy, Columbia University. Published by Sauveur & Whitting, 446 Tremont Street, Boston, Mass. Price, $5.

This book is a thorough and concise summary of present knowledge regarding theory and practical applications of metallography. The work gives the essential features of the processes now used for production of iron and steel, together with a clear statement of the principles and effects of heat treatment. It will be found a most useful aid to manufacturers having to do with iron and steel products, as well as also to the student and beginner.

The Daughter of a Magnate. By Frank H. Spearman. Published by Charles Scribner's Sons, 153 Fifth Avenue, New York. Price, $1.50.

The railway is one of the greatest human institutions and the manner of its development and character of its service to mankind renders it a field for romance, which thus far has been but little cultivated. Mr. Spearman has been very successful in this story, which has the real fire and life of the railroad and gives an idea to the uninitiated of the inspiration of railroad life. The book will be read with pleasure by those who live in the atmosphere of railroad work and with interest and profit by those who only know of it by hearsay.

Threads and Thread Cutting. By Colvin-Stabel. 32 pages, 6 x 9 inches, in pamphlet form. The fourth of a series of practical papers, each complete in itself. Published by the Derry-Collard Co., 256 Broadway, New York. Price, 25 cents.

This is another of the series of practical papers published by this company, which will be of interest to every machinist. Thread cutting has its little mysteries for one until the matter contained in this pamphlet is studied. It makes clear many of the intricacies of thread cutting and serves as an introduction to all kinds of thread cutting. It contains a number of handy little kinks, gives many useful tables, and includes also the subject of thread milling. The pamphlet is well illustrated and is well printed on an excellent paper, making a very attractive pamphlet and one that will be appreciated by any machinist.

Fowler's Electrical Engineers' Year Book, and Directory of Lighting and Power Stations, for 1904. Published by the Scientific Publishing Company, Manchester, England. 539 pages, pocket size, bound in imitation leather. Price, 1s. 9d.; probable cost in this country, about 75c.

This well-known little reference book has been brought up to date by the addition of the Institution of Electrical Engineers revised general rules for wiring, and the Board of Trade regulations and statutory rules relating to tramways, light railroads and electric lighting. Many portions have been rewritten, as, for instance, those on measuring instruments, electric distribution, meters and

dynamos. New matter has been introduced relating to alternating-current transmission and induction motors. The directory of electric light, power and traction stations of the United Kingdom, which is a feature of this book, has been revised and brought up to date, and the particulars of over 500 installations are given. The success of this little work is to a large extent due to the continuous and painstaking efforts that have been made to improve its usefulness and keep it abreast of the times, and its favorable reception is a warm testimonial of its value. While the book is primarily adapted to the use of British engineers, it is also of value to those who may have frequent need of a ready reference to subjects and principles pertaining to electrical engineering.

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Machines and Tools Employed In Working Sheet Metals, By R. B. Hodgson, Published by the Technical Publishing Co., Limited. D. Van Nostrand Co., Warren St., New York, 1903 Price Four Shillings and Six Pence.

This book is by the author of Emery Grinding Machinery, and the work first appeared serially in the pages of *The Practical Engineer*, being now put into book form at the request of many readers of the articles. This subject is generally understood only by the press-tool makers, because of the fact that many points of technical detail surround the processes of pressing work from flat sheets. The author has had a wide experience in this line of development and presents the work in the hope of aiding engineers and manufacturers in overcoming some of the difficulties met in technical schools and workshops. While this sort of machinery is a distinct specialty, it is well to know where to look for such thorough treatment of the subject, as this work presents. The book deals with materials and measurement, gauges, presses, dies, metal spinning, drawing, stamping, tools, blank dimensions and pressures for cutting blanks. It is a valuable book for those who work in sheet metal.

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Suplee's Mechanical Engineer's Reference Book. A Hand-Book of Tables, Formulas and Methods for Engineers, Students and Draughtsmen. By Henry H. Suplee, B. Sc., M. E., Member American Society of Mechanical Engineers. Pocket Size, 834 pages. Bound in Red Leather. Published by J. B. Lippincott Co., Washington Square, Philadelphia, Pa. Price, $5; with patent thumb index, $5.50.

This excellent hand-book has been in preparation for several years by Mr. Suplee, being intended as a successor to the formerly well-known reference book edited by John Nystrom and also published by the J. B. Lippincott Co. It is, however, an entirely new work, and nothing of the old hand-book has been retained except with the necessary complete revision to bring it up to date. This work is particularly well equipped with tables, and has an unusually large amount of reference matter. It is divided up into departments, according to the various engineering subjects, each of which is treated very fully, and the entire work is carefully indexed. The metric system has received careful attention, and full conversion tables have been incorporated in the work. This work will take an important place with the other modern hand-books for engineering practice, and will be highly appreciated by those desiring a modern mechanical engineering hand-book. The book is well printed on a fine quality of paper, and is beautifully bound in red leather, with gilt edges. An innovation has been introduced in the patent thumb index, on the dictionary plan, which gives marginal indexes to the various engineering subjects treated in the volume; this will prove a great convenience for quick reference work.

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We beg to acknowledge receipt of calendars from the following firms: Morgan Engineering Company, Alliance, Ohio; Cleveland Pneumatic Tool Company, Cleveland, Ohio; Ashton Valve Company, Boston, Mass.; National Electric Company, Milwaukee, Wis.; Kennicott Water Softener Company, Chicago, Ill.; Ingersoll-Sergeant Drill Company, New York; the G. Drouve Co., Bridgeport, Conn.; H. B. Underwood & Co., Philadelphia; American Steam Gauge and Valve Company, Boston, Mass.; Springfield Machine Tool Company, Springfield, O.; Brady Brass Company, New York; Photo Engraving Company, New York.

B. M. Jones & Co.—We are in receipt of a beautiful little vest-pocket diary and memorandum book entitled "A Daily Reminder of Important Matters," which has been issued by B. M. Jones & Co., Boston, Mass. It is artistically bound in a pretty mottled leather, and includes, besides interesting tables and formulæ, several comprehensive maps of portions of the United States and its island possessions. This little volume calls attention to the fact that their R. Mushet's special high-speed tool steel has been adapted to recent requirements and is capable of cutting at high speeds, coarse feeds and heavy cuts, and will also turn the hardest materials in either cast iron or steel. Their long experience enables them to guarantee uniformity in every bar supplied.

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## NEW WORTHINGTON PLANT.

An extensive pump manufacturing plant, the largest in this country and probably in the world, is now under construction at Harrison, N. J. It is to be occupied by the firm of Henry R. Worthington, who employ about 3,000 men in their present works at South Brooklyn, L. I., and Elizabethport, N. J. The new plant at Harrison will accomodate from 4,000 to 5,000 men and will cost in the neighborhood of $2,000,000. It consists of a main machine shop with side galleries over 1,006 ft. long, an erecting shop 592 ft. long and of the same section as the machine shop and a high erecting shop 210 ft. in length and four galleries in height in the side bays connecting the two shops. The main foundry is 600 ft. in length and there is also a special foundry for small work, 410 ft. in length, with a building 200 x 60 ft. in size for cleaning castings connecting the two. The pattern building is four stories high and 550 ft. long, and is divided by fire walls into four sections. The north section will be used for offices and drafting rooms; the adjoining section for the pattern shop and the balance of the structure for pattern storage. The power house, which will be equipped with the most modern boilers, engines and generators, is a building 172 x 102 ft. Electric power distribution is to be employed throughout, and the grounds will be illuminated by electric arc lights. There are many other buildings which will be used for packing, storing and shipping goods, etc. The buildings are so arranged that additions can be built when the work demands it. All will be connected by a complete system of railroad tracks entering the ends of the buildings and placing the works in direct communication with the Delaware, Lackawanna & Western, the Erie and the Pennsylvania Railroad systems. The new plant will be devoted entirely to the manufacture of water works machinery, water meters, cooling towers, condensers, feed-water heaters, centrifugal pumps and steam pumps of all kinds.

## EQUIPMENT AND MANUFACTURING NOTES.

The Chicago Pneumatic Tool Company.—In an opinion rendered December 21, 1903, the United States Circuit Court of Appeals (now the court of last resort in patent litigation) sustained the validity of the Boyer patent No. 537,629 of the Chicago Pneumatic Tool Company, issued April 16, 1895, and declared the pneumatic hammers manufactured by the Keller Tool Company and sold by the Philadelphia Pneumatic Tool Company to be an infringement of claims 42, 45, 46, 47 and 48, awarding a decree for an accounting and a perpetual injunction against the further manufacture, sale or use of infringing tools. Injunctions will therefore issue against the Keller Tool Company and the Philadelphia Pneumatic Tool Company and all other manufacturers, dealers in and users of infringing tools.

In the lower court the bill was dismissed on the ground of non-infringement, and it was in the Circuit Court of Appeals approached from that side. The patent in suit, issued to Joseph Boyer in 1895, expressed the features of the invention in a large number of claims, but only two groups were the subject of consideration in the court below. These cover the means for controlling the supply pressure to the mechanism by valves and ducts incorporated in the handle of the tool and used in connection with passages leading to the air cylinders through portions of the handle which is grasped in operating it; these claims were shown to be infringed. The defendant was found to be making use of a throttle valve similarly located in the handle as described in the Boyer patent; it operated equivalently to control the admission of fluid pressure into and through the duct. So far as the Boyer claims 42 to 45 are concerned, no particular form of construction or mode of operation was specified in them, and none is, therefore, to be imposed; the combination is simply that of a throttle valve in the handle in conjunction with a supply duct running through it, and that is all that is required to fulfill their terms.

The utility of the invention was assailed on the ground that no tools are now constructed in accordance with the patent, and have not been, as it is said, from almost the time it was granted; but this did not fairly present the evidence. The plaintiff testified that some 200 tools of the exact construction there described were made and sold in 1894 and 1895, but were recalled on account of improvements which were added to make the machine more durable; these were embodied in two subsequent patents, one the same year, in November, 1895, and the other in January, 1897, but were for

changes in other parts of the instruments, the combination which is here involved being strictly maintained and followed. It is, of course, true that the flexible rubber tube method of closing the valve chamber was given up and a valve of somewhat different character substituted. But the combination in issue does not depend, as we have seen, on the particular kind of valve employed, and the change was therefore no abandonment of its essential features, which still obtain, and in accordance with which thousands of tools have been manufactured and disposed of. Their extended use in the shipyards, railroad shops, boiler works and other similar industrial establishments throughout the country testifies unanswerably to their utility and value.

This unanimous decision of the United States Circuit Court of Appeals in favor of the Chicago Pneumatic Tool Company gives them the exclusive right to manufacture, sell and permit others to use the modern pneumatic hammer, as every other pneumatic hammer on the market infringes their sustained claims. They state most plainly that all makes of pneumatic hammers are declared infringements by this decision, and that pneumatic tools can be purchased only from them without liability to injunction and heavy damages.

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O. C. Gayley, manager of the New York office of the Pressed Steel Car Co., has been elected a director of the Safety Car Heating & Lighting Co., succeeding Edward Lauterbach, recently resigned.

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The many friends of the Coffin-Megeath Supply Company will be interested to learn that upon January 1 the firm name was changed to the Franklin Railway Supply Company. The headquarters of the company will remain at Franklin, Pa., as before. It is expressly stated that the change in title does not in any way affect the personnel of the company, and no change has been made in the officials.

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Mr. Willis C. Squire, mechanical engineer, has been elected vice-president of the Locomotive Appliance Company, with offices at 1614, 1615 and 1616 Chemical Building, St. Louis, Mo. Mr. Squire is well known as mechanical engineer for the 'Frisco system, and previous to that as engineer of tests for the Sante Fe system. Mr. Squire's large experience in railroad and locomotive work especially fits him for the business in which he is now engaged.

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We are pleased to learn that the Ajax Metal Company, of Philadelphia, Pa., have purchased the business, plant, good-will and fixtures of the late Bates Metal Company, of Birmingham, Ala., and will continue the metal business in all its branches, under the name and title of the Ajax Metal Company of the South, at Birmingham, Ala. This new departure will materially assist the Ajax Metal Company in caring for its extensive business in the South, and will be welcomed by their many friends in that territory. The Ajax Company has the best wishes of this journal for a prosperous year to come.

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At a recent meeting of the board of directors of the Consolidated Railway Electric Lighting and Equipment Company, held January 13, Colonel John T. Dickinson, heretofore their general agent, was elected second vice-president, in charge of negotiations with the railway companies for the use of the Consolidated "Axle Light" system of electric car lighting. It will also be remembered that the company's general offices were recently moved from 100 Broadway to the Hanover Bank building, corner Pine and Nassau streets, New York City.

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The Loomis-Pettibone Gas Machinery Company has, after their recent increase in capital, been merged with the Holthoff Machinery Company, of Milwaukee, Wis., under the new corporate name of Power and Mining Machinery Company. Extensive improvements and additions are now being made to their Milwaukee plant to meet the increasing demand for the American Crossley Gas Engines, the Loomis-Pettibone Gas Apparatus, and Holthoff Mining Machinery. The Loomis-Pettibone gas producers have established for themselves a world-wide reputation as the only gas producers successfully generating a fixed gas for power and metallurgical work from either anthracite or bituminous coals, coke or wood. The Crossley gas engine, of which there are over 50,000 in operation, and which this company are now building as the American licensees, effects remarkable economies; it is assured by their guarantee to produce power with a consumption of 1 lb. of good bituminous coal per brake horsepower hour. The manufacture of mining, smelting and milling plants and machinery will be continued under Mr. Holthoff's personal supervision.

Owing to a large increase in their business throughout the West, Manning, Maxwell & Moore have, for the benefit of their customers, arranged to establish a Western branch office and salesroom at Nos. 22, 24 and 26 South Canal street, Chicago, where they will carry a full and complete line of the goods manufactured by them, thus enabling them to fill orders from the Western territory with promptness. The Western office will be in charge of Mr. H. S. Whitney and Mr. M. A. Hudson, who have been connected with this firm for a number of years. All of the friends and customers are invited to call at the new office, where they will find a most complete assortment of goods manufactured by the Hayden & Derby Manufacturing Company, the Ashcroft Manufacturing Company, the Consolidated Safety Valve Company, and the Hancock Inspirator Company, in stock ready for immediate delivery.

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One of the features of the new plant of the B. F. Sturtevant Co. at Hyde Park, Mass., peculiarly indicative of the permanent character of the new works now under construction, is the steam tunnel, 4½ ft. in width and 6½ ft. high, extending from the power plant to the most remote part of the manufacturing buildings, a total distance of about 800 ft. This tunnel, which is of concrete construction, will not only accommodate all of the steam piping, but also the electric wires for power, light, telephone, standard-time clock, and other service, together with oil, hot-water and other pipes for general distribution to the various buildings of the plant. None of these features of the equipment will be carried above ground at any outdoor point. While the expense of such an installation is necessarily large, the convenience of access for changes and repairs will in the future much more than offset any fixed charges thereon.

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The new mechanical system for operating window sashes and shutters, recently placed on the market by the G. Drouve Company, of Bridgeport, Conn., and known as the Lovell apparatus, is destined to revolutionize business in this important line. The extent of the approval which this apparatus has met from mill owners, railway companies, factories, etc., has been such that equipment for operating over 60,000 feet of window sash has been sold in the past year. With the Lovell system a line of sash 500 feet long can be operated from one station if desired. It makes no difference what kind of sash is to be opened; the apparatus works equally well with sash hung from the top, pivoted at the sides or at the top and bottom, or hinged at the bottom; it can also be applied to sliding or ordinary lifting windows. As the operating station for an entire building is, unless otherwise ordered, always placed on the wall at the end or side of a building, in case of fire the windows can be quickly closed, while the people are leaving the building—this is a feature which will appeal at once to owners for use in large factories and mills, railway shop buildings, etc. Owners of factories and shops have long been looking for a system which would give perfect ventilation and permit of being operated easily and quickly in case of storm or emergency. This apparatus is strong, durable and practical, and the Drouve Company justly feel that they have at last succeeded in producing a perfect opening device, and they will cheerfully submit estimates for erecting the apparatus in any part of the country. Their skylights and sheet-metal work are favorably known everywhere.

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That veteran but gay and graceful minstrel, George H. Primrose, who has been nearly thirty-five years on the stage, and still gives the impression of perennial youth, had something to say recently about the Proctor playhouses, in which he is at present playing a somewhat extended engagement at a joyful salary of something very close to $1,000 per week. "I have never passed a more pleasant engagement," said Mr. Primrose, "than I am now enjoying on the stages of Mr. Proctor's various theaters. They show most conclusively the high degree of perfection attained by the modern vaudeville playhouse. Twenty, yes, even ten, years ago, I would not have believed it possible that the patrons of what we were then wont to call a variety show would ever be enabled to enjoy their favorite form of entertainment amid luxurious surroundings, managed with such rare skill, and affording so much delight to the thousands of people gathered within the four walls. Not alone does the beauty of the theaters themselves compel attention, but in the careful detail of the handling of the stage there is much to wonder at and praise." An advantage of the Proctor theaters is that they are safe and protected from fire.

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WANTED.—Copies of the AMERICAN ENGINEER AND RAILROAD JOURNAL for the months of February, March, April and May of 1899. Address replies to this office.